# MAIN CURRENTS

## IN MODERN THOUGHT

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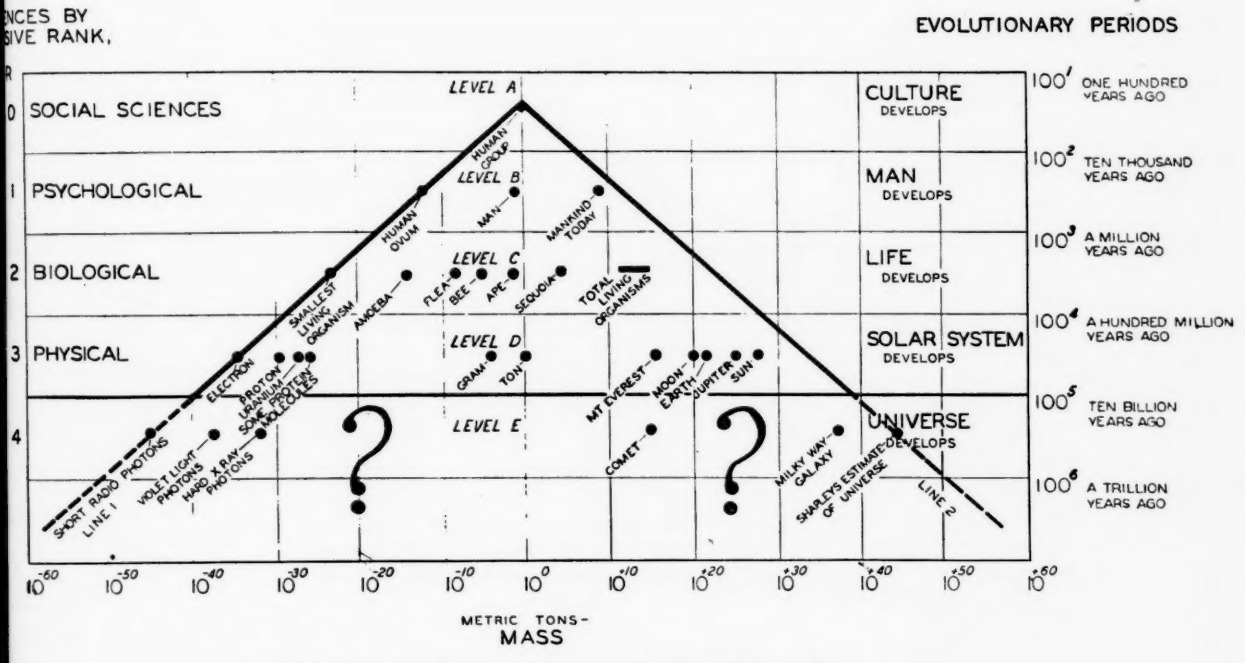


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Data from W. O. Kermack & P. Eggleton, "The Stuff We're Made of," Science Book Club, 1938.
Harlow Shapley, "Flight from Chaos," McGraw Hill 1930.

S. C. Dodd

FOR DISCUSSION

PLEASE SEE PAGE 122

# MAIN CURRENTS IN MODERN THOUGHT

*A co-operative journal to promote the free association of those working toward the integration of all knowledge through the study of the whole of things, Nature, Man, and Society, assuming the universe to be one, dependable, intelligible, harmonious.*

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The Journal of the Foundation for Integrated Education, 220 East 42nd St., New York 17, N. Y.

*"Ah, but a man's reach should exceed his grasp, or what's a heaven for?"* — BROWNING

Editor: F. L. KUNZ Associate Editor: E. B. SELLON

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### AIMS OF THE FOUNDATION FOR INTEGRATED EDUCATION

The Foundation is incorporated under the laws of the State of New York as a non-profit educational organization. Contributions are tax deductible.

*The corporate statement of Aims* declares that the Foundation has been established:

1. To collect, create, and distribute authoritative materials which will encourage the development of unified overall concepts in education; to improve the balance of relationships between the physical sciences and the social sciences; to inquire into the phenomena of purposive activity in nature, man and the universe.

2. To assist teachers to understand and use such materials, and to develop an active, realistic, comprehensive philosophy which will communicate to their students the unity, coherence, and beauty of the world in which we live.

3. To remedy, solely by such educative measures, the conceptual and hence the ethical, social, economic, and political breakdown of our times, looking to a peaceful world order.

The members, associates, and staff of the Foundation realize that the progressive discovery of unifying over-all concepts concerning man and the universe is not a task to be performed successfully in isolation from the historical, social, economic, and political context of our times, nor in terms of application less than global.

The work of the Foundation is wholly educational, yet referred constantly to the contemporary scene in all its aspects, no less than to the total available wealth of human experience and knowledge.

*MAIN CURRENTS IN MODERN THOUGHT is published quarterly to call attention to significant contributions to learning currently being made by leading workers in the multiple fields into which knowledge has come to be classified. It relates these advances to each other and to the classical and contemporary views of Eastern, European and American thinkers. It is designed to save time for the reader by providing a vantage-ground from which the whole world of knowledge may be surveyed and kept in proportion as it moves toward integration. Its editors assume that the principles of art, the universals of philosophy, the laws of Nature and Man as formulated by science, and the truths of comparative religion, can be orchestrated into a harmonic, meaningful, ethical body of teachings which can and should be made the central core of curricular study in the educative process at all levels of development. In condensing text, square brackets [ ] indicate editorial interpolation. Three dots . . . in the text indicates a word, phrase or passage omitted in the interest of brevity or clarity. Other usages are standard. $3.00 a year. Foreign $3.50. Contributors to MAIN CURRENTS enjoy full liberty of opinion and expression in these pages.*  *Port Chester, New York, to whom all communications regarding MAIN CURRENTS IN MODERN THOUGHT should be addressed. Entered as second class matter April 13th, 1946, at the post office at Port Chester, New York, under the Act of March 3rd, 1879.*

# FOUNDATION FOR INTEGRATED EDUCATION

## News and Notes

The Stillwater Conference — on the nature of concepts, their interrelation and role in the social structure — held in Stillwater, Oklahoma, in June, conducted by the Foundation for Integrated Education and co-sponsored by Oklahoma Agricultural and Mechanical College, proved indeed to be all that was expected of it.

The hospitality of President Henry G. Bennett, Dean Schiller Scroggs, and many colleagues, was incomparable. As is customary at the conferences of the Foundation, the company was housed together in one of the many beautiful new structures at the college that was allocated to us. Facilities were provided for the conferees to eat together in changing groups and to visit on the terrace into the large and small hours of the night. The principals thus came to know many participants individually, and for this they made themselves available most generously.

President Bennett brought the faculty and delegates together at a dinner, thereby giving opportunity for the searching opening address by Dr. Kirtley F. Mather, President of the Foundation, "Education for Citizenship in a Changing World." All this considerateness, and a feeling of new hope, gave the Conference vitality.

Active participation of members of the faculty of the College, especially those in the General Education Program, provided a representative cross-section of the thinking in all departments of a great state university. In addition, the Foundation, as co-sponsor, had attracted representatives from 20 states. This wide spread, from Washington and California, to Maine and the South, with scattered representation from the middle states, constituted an equal national geographical sampling of higher education. Finally, participation included teachers from Catholic, Protestant, and other church-affiliated universities and colleges, as well as state institutions and even representation from preparatory schools. Certainly if integration is to mean anything, it must work within precisely such and even greater diversity.

The contribution of the principals will be published in a volume, an advantage due directly to the lively interest of President Bennett and Dean Scroggs in the work of the Conference and the Foundation. Inquiries about the Proceedings may be addressed either to Dean Schiller Scroggs, Oklahoma A. & M. College, Stillwater, Oklahoma, or to F. L. Kunz, The Foundation for Integrated Education, Room 1605, 220 East 42nd Street, New York 17, N. Y.

We print in our present pages the address made by Dr. Clyde K. Kluckhohn, Harvard University, on "The Special Character of Integration in an Individual Culture," and from this the reader will be able to judge for himself how direct the discourses and discussions tended to be.

From the address of the Chairman, Dr. F. S. C. Northrop, Yale University, opening the main proceedings, the company expected to receive the major constructive thrust, and in this certainly they were in no degree disappointed. Speaking on "The Nature of Concepts and Conceptual Structures," Professor Northrop brought up at the very start the whole question of the nature of human thinking, the limitations of philosophy derived principally from sensory experience, and the role of structured science in valid knowledge. All present were made instantly aware that the Conference was going to be devoted, precisely as intended, to the very foundations of the integrative program. This essentiality and directed impetus was fully maintained when the co-chairman, Professor Henry Margenau, also of Yale, attacked the problem from the special point of view of "The Methodology for Integration in Physical Science." The reader will find all of this, and much more, in the Proceedings.

More than one delegate expressed to the present writer an initial feeling of being confronted with demands uncompromising and basic in their nature, and difficult to meet without extraordinary efforts and considerable changes in outlook. But is it not precisely this challenge with which any practical program in integrated education must expect to find itself involved? The re-balancing and internal improvement of a few general education courses does not constitute, in itself, conceptual interknitting of subject matter. The shock of head-on collision with the new challenge wore off during the second day, as gradually speakers and discussion made contributions from psychology, sociology, anthropology, and other broad fields. Here Dr. Claude E. Hawley, representing the Office of the Federal Commissioner of Education, was particularly useful. His experience of general education in visits on many campuses and his special knowledge of social studies enabled him to evaluate and interpret the fundamental purposes of the Foundation in practical terms. Dr. Muzafer Sherif, The University of Oklahoma, poured out a full measure of that penetration and subtlety which should indeed appropriately come from his special field, social psychology.

One of the most delightful aspects of Stillwater was the reappearance of participants from the

earlier Foundation Workshops in the University of New Hampshire, 1948, Wellesley College, June 1949, and Montecito, California, August 1949. This continuity allowed of special contributions by men familiar with our program, like Dr. Alvin Hague of Redlands University and Edwin Haskell, research associate of the Foundation, at hours left open for this purpose.

During the Conference, the Foundation most fittingly offered its annual citation for 1950 to Oklahoma Agricultural and Mechanical College "for pioneering and progress in the field of integrated education in its own program and for its conspicuous contribution to the cause of integrated education in the nation." This award is not an arrogation by the Foundation. It constitutes an expression of grateful appreciation for efforts in the difficult field to which the Foundation is committed. It is most natural that we signal with satisfaction strong cooperation of gifted, experienced, and resolute educators.

F. L. Kunz

## BRIEF ITEMS

"Integrative Studies for General Education" is the title of the Symposium which the Foundation for Integrated Education has been invited to conduct for Section Q (Education) of the American Association for the Advancement of Science in Cleveland, December 28. The program follows:

1. "Objectives and Nature of Integrative Studies," by Dr. Kirtley F. Mather, Professor of Geology, Harvard University, President of the Foundation for Integrated Education.

2. "Team Work in Building a General Key Concept," by Dean Schiller Scroggs, Oklahoma Agricultural and Mechanical College.

3. "The Role of a Biological Field Theory in Education," by F. L. Kunz, Counsellor on Studies, Foundation for Integrated Education.

4. "Integration in the Sciences," by Dr. Henry Margenau, Higgins Professor of Physics and Natural Philosophy, Yale University.

5. Discussion.

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Contact has been established with the New Zealand Council for Educational Research, A. E. Campbell, Director, Wellington, New Zealand. Recent issues of MAIN CURRENTS have made the work of our Foundation known in that quarter. The Director of the New Zealand Council has kindly offered to assist in making our program better known in New Zealand. MAIN CURRENTS is being sent for like purposes to educators in Australia, India, and the British Isles.

We have also received a letter expressing interest in the work of the Foundation from R. G. Cameron, Professor of Education, The University of Western Australia, Nedlands, Western Australia.

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# THE FOUNDATION FOR INTEGRATED EDUCATION PURPOSE AND PROGRAM

Kirtley F. Mather

Harvard University

At this mid-point of the Twentieth Century, the world of humanity is a world in fragments. We are far indeed from making the necessary adjustments to the new environment resulting from the swift progress of science and technology during recent years. It will not be easy for men to learn how to live peacefully and securely in a somewhat crowded world of inescapable interdependence and potential abundance, but that is obviously the requirement that we face. To use the rich resources of the bountiful earth for the welfare of all, with increased efficiency, better health, and more comfortable existence for each of its inhabitants, is, of course, the objective of every intelligent, well-meaning person. We are pretty much in agreement about the aims of life in the second half of our century, but we are in sharp disagreement about the methods of social, political and economic organization that should be used to move forward toward the common goal. In fact, few if any people are quite certain what the practical solutions are for the many specific problems that press so insistently upon us all in the radically new and poignantly complex world situation. We lack the firm foundation of shared knowledge, of basic understanding, of sure direction, that is essential to the forward march of mankind.

Here is obviously the ringing challenge to the many educational institutions, enterprises and forces in the community. Something more is needed than the building of mere bridges of tolerance and good-will across the chasms of prejudice and fear that separate the fragments of humanity. Something must be found and promulgated to close those chasms and integrate the minds and hearts of men so that mankind will be as truly one as is the physical world on which we dwell. Only a new type of education for citizenship in the world society, as well as for the technical ability to earn a living, can hope to

succeed. Education must itself be integrated if it is to deal adequately with body, mind, and spirit, with science, art and ethics, with technical skill, aesthetic needs and social relations. This we take as the objective of the Foundation for Integrated Education.

To advance toward that objective, the Foundation must work on two fronts. On one hand, it must deal with educational programs in schools and colleges; on the other, it must prosecute and stimulate research concerning the nature of knowledge and the fundamental integrative principles that could provide the necessary basis for the unification of mankind. Both aspects of the Foundation's program are recognized quite generally as absolutely essential to progress toward a peaceful, orderly, world society.

Many colleges and universities are now overhauling their programs of study and experimenting with new courses in their curricula. New programs of general education and the introduction of "core courses" have lately become characteristic features on almost every campus. Much of this is a reaction to the familiar trend toward increasing specialization of teachers and subdivision of faculties into departments. Analysis of ever smaller segments of reality has gone so far that the need for synthesis of the various intellectual disciplines has led to the recognition of overlapping fields, such as biochemistry and geophysics. In some institutions, moreover, an attempt is being made to bring together the fruits of research in many diversified sectors of human endeavor and put them before the students as a unified whole.

An important function of the Foundation for Integrated Education is to serve as a channel of communication for the exchange of information among those teachers and colleges that are trying experiments and developing novel programs. A considerable store of information about the successes and failures of such experimental programs is now available to assist other institutions in revising their curricula with the greatest possible effectiveness. In workshops and conferences, and through the medium of the Foundation's journal, MAIN CURRENTS, this information is being gathered and made accessible for all interested educators.

The Foundation, however, seeks to be something more than merely a reservoir of information and channel for its dissemination. It has its own developing philosophy of education and its desires to propagate its own ideas, as they are perfected through reflection and application. There is danger that "general education" may become superficial and shallow, because of the necessity for making it all-inclusive and broad. Not yet do educators feel absolutely confident that they know precisely what are the very best procedures to use in "education for citizenship," as distinct from "training for a vocation." At least, not all educators are in agreement about the methods most conducive to attaining the results that all would like to see. It is the present belief of those responsible for the program of the Foundation that the focus should be upon integration of knowledge, as the name of the Foundation implies, rather than upon the acquisition of a smattering of information from many disciplines, as the term "general education" might be perverted to imply.

This concept of the nature of education for citizenship in the world of tomorrow makes all the more necessary the second aspect of the Foundation's program. Most of us believe — perhaps, in large degree intuitively — that there is an underlying, integrating, unifying principle that in some way characterizes the cosmos of which we are a part and makes it truly a universe. Presumably this principle manifests itself in various ways in physics, chemistry, biology, psychology, sociology, history, philosophy, art and ethics. The manifestations are diverse and manifold, but the administrative principle responsible for them is presumably *one*. Just what it may be, none of us are sure. But we are committed to the search for it. Recent progress in such widely separated fields as nuclear physics and gestalt psychology gives hope that the search may not be in vain. There is much encouragement from those who work on the far frontiers of knowledge that the basic marching orders for the organization of the universe are not only very potent and profound, but also very meaningful and simple. If we could lay our intellectual hands on them and proclaim them in terms that would be comprehended by all thoughtful persons, it would be a contribution of superlative merit to the welfare of all mankind.

The search for the underlying principle that would give vitality to integrative education may seem to be an academic task. It must indeed be prosecuted by specialists in the various disciplines of learning, but they must be persons, like those already embraced within the activities of the Foundation, who are concerned not only with the acquisition of knowledge but also with its practical application in everyday life. Research, even though it be as esoteric as this, must be considered only as a means to an end. The end is the integration of mankind, the widespread acceptance of the concept of unity and community which must inevitably precede the attainment of world order. This gives to the work of the Foundation a significance that cannot escape the attention of all who are concerned in any way with the pressing problem of transforming the chaotic, dangerous, broken, enslaved world of our day into an ordered, peaceful, free and harmonious world of tomorrow.

# THE SPECIAL CHARACTER OF INTEGRATION IN AN INDIVIDUAL CULTURE*

Clyde K. Kluckhohn

Harvard University

To begin my remarks this evening, I should like first of all to sketch briefly — and therefore somewhat abstractly — the burden of my argument. (I hope to fill in content later.)

As far as integration, and especially integration in education, are concerned, there are two points I should like to make. The first is the necessity for a conceptual scheme which cuts across the traditional academic disciplines. The second is the need for more emphasis upon structure and form as opposed to content.

For a cross-cutting conceptual scheme I propose the basic premises and categories in terms of which human beings organize their experience, especially those concerned with values and with underlying images of nature. This is essentially Dr. Northrop's point of yesterday — the need for a least common denominator.

Every successful science or every successful attempt to gain an intellectual conception of human experience has always had certain major conceptual entities. For example, in classical physics there are mass, energy, and so on. For the studies that deal with human beings (whether they be called humanities, social sciences, human biology, or psychology) the concepts that relate to what is inevitably and universally human are of comparable significance. Those are the premises, tacit or explicit, and the categories that define the view of nature and of man's place in it, that set these existential assumptions in a framework of value-orientations.

Every man must face the same inescapable problems, whatever his culture: he must get food and shelter, and learn to cope with birth, illness, love and death. This is without doubt a platitude, but we should remember that no statement becomes a platitude unless it is interesting and important. Since all people face the same dilemmas, all cultures are just so many different answers to identical questions, and the variations and similarities in these answers will never be understood until the primitive categories and distinctive postulates of each culture are perceived. The patterns of all cultures crystallize around certain invariant points of reference: the conditions given by biology, by the nature of the external world, and by the universalities of social interaction. These are all very simple yet extremely important things, such as the existence of two sexes, the helplessness of infants, the mutual dependence of members of a group, death.

That is my first general point. The second, which is very closely linked, is that in general education we need to pay more attention to structure and form as opposed to sheer content. In the social sciences-humanities field, for example, we should remember that history consists of patterns as well as events.

Those are my two central points, and everything that I say later will, I hope, be found to be variations upon these two themes.

As an anthropologist, I must speak about culture. I do this unashamedly, because I am prepared to defend the position that culture is a concept comparable in its generality and its explanatory importance to such concepts as gravity in physics, evolution in biology, and so on. Our studies have convinced us beyond question that the basic model upon which the behaviorists and positivists and many others have acted in the past — the model of common sense — is inadequate. By retreating to the simplest possible level, we find ourselves, do we not, with two things: a body, or organism, and an environment in which the organism reacts to stimuli or to stimulus situations. Actually, of course, we know that human beings never react to stimuli except at the level of reflexive behavior and under certain conditions of extreme environmental stress. Human beings always react to stimuli as interpreted, not to the stimuli as they exist in the external world. There is, as it were, an intervening variable which always lies between the organism and the environment. Psychologists have in the past often called this the total apperceptive mass, and I think it is substantially identical with what McCulloch calls reverberating neural circuits or neural networks. It is only the immediately born human organism — the infant an hour old or less — that reacts freshly to its experience, as a machine of certain properties would respond to specific changes in its environment. No, we humans do not respond as machines. We respond to stimuli only as they are evaluated in terms of our previous experience. The content of this total apperceptive mass or these particular neural pathways is thus created in part by our individual experience, but also in large measure by the distinctive life-way to which we happen to belong — our culture.

I shall not attempt here to give a technical description or definition of culture, but shall simply say that it is the life-way of a people. The culture is, as it were, built into the neural system of the organism, and will often affect behavior that at first glance seems to be purely biological. Let me give an example which I have found useful with students.

I used to have a friend out in the Navaho reservation, the wife of a trader who lived about

*Report of an address at the Stillwater Conference, June, 1950.

190 miles from a railroad. When white ladies visited this remote trading post, she would, of course, offer them some refreshments, and the ladies would nobly fulfill their culture patterns and say, "Oh, what delicious sandwiches, my dear! I just can't decide whether they're tuna fish or chicken, or is it some combination?" My friend, Mrs. O'Farrell, although never quite sure whether she was an experimental scientist or a sadist (our psycho-analytic friends tell us there is some connection), in any case kept a meticulous record of the number of ladies who asked this question over a period of years, and the proportion of them who, upon hearing the recipe, lost their refreshments, sometimes before they could get out of the room. She no doubt paid for her sins, but this well illustrates the dominance of a culture pattern, because rattlesnake meat is delicious, nutritious, and easily digested; there is no constitutional reason why it should have upset the poor ladies. We may say that they were affected by a purely biological reaction, but the cause cannot be put in the framework of the biological at all. This illustrates how the intervening variable, culture, interposes between the organism and the environment.

Now, culture not only operates in the form of a particular attitude (one of the social norms that Dr. Sherif has mentioned) but what is more to the point for our interests here, it has organization as well as content. It goes over into the realm of ideas. Speculation and reflection upon man's place in the total scheme of things, upon the aims and virtues of individuals and groups, are carried out in every known culture, including the "most primitive."

The human individual is endlessly simplifying and generalizing his own view of his environment, and constantly imposing on this environment and on the events which occur in it his own constructions and meanings, but these constructions and meanings are largely group products of men and women who lived long ago. In other words, they are, in part at least, characteristic of one culture as opposed to another. It is true, of course, that no two individuals within a society have an identical set of basic concepts, explicit or implicit, conscious or unconscious; each person adds a little here, detracts a little there, makes this or that emphasis stronger than do most of his neighbors. Indeed, the cultural system of premises and categories is an abstraction, a statement of central tendencies and a range of dispersion. It is a meaningful and highly useful abstraction, but we must never lose sight of the fact that it *is* an abstraction none the less.

It is also true that there is much greater similarity between the underlying conceptual images of different cultures than would appear superficially. The attention of most of us — including, unhappily, that of the anthropologists also — has been caught too exclusively in recent years by the obvious cultural differences between peoples, with a consequent minimization of their equally important similarities. Both must be evaluated for a full understanding.

The same thing is true of the individual. The clinician, or psychiatrist, tends to see only the differences; the social psychologist tends more to see the similarities. Yet both are equally important factors in establishing a more or less unified value system that gives direction to the life of every individual at any given point in his history. Though each personality gives to this value system an idiosyncratic coloring, this is primarily in its affective dimensions. The main outlines of hierarchical preferences have only exceptionally been created out of the stuff of unique biological heredity and peculiar life experience. They are usually cultural products in the main, and from the lifeways that constitute the designs for living of his community, or tribe, or nation, or socio-economic class, or civilization, the ordinary individual derives most of his basic conceptual orientations. Cultures or group life-ways do not manifest themselves solely in observable customs and artifacts. A valid sociology can never be erected on the canons of radical behaviorism. There is much more to social and cultural phenomena than immediately meets the eye or ear. If the behavioral facts are to be correctly understood, certain essentially philosophical propositions must also be known. The strain toward consistency which Sumner noted in the folkways and norms of all groups cannot be accounted for except in terms of a systematic, even though partly unconscious, hierarchy of values.

I remarked yesterday that in a certain deep sense the logic (which is the manner of interpreting relationships between phenomena) of all members of the human species is the same. The difference lies in their value premises and existential conceptions about the nature of the external world and of human beings. These premises are learned primarily as part of a cultural tradition. Such degree of synthesis as exists within a culture is achieved partly through the overt statements of dominant conceptions, assumptions and aspirations of the group in its religious beliefs, secular thought and ethical code, and partly through unconscious apperceptive habits — ways of evaluating the stream of events which are so taken for granted as seldom or never to be verbalized explicitly except when challenged from without.

These habitual ways of begging certain questions that are distinctive of different cultures may be clearly crystallized in the morphology of the language, as Dr. Hubert Alexander and Mr. B. L. Whorf have shown. For example, the system of European languages points to the enormous value which we in the West place upon our particular kind of time. To the outside student of our culture, these linguistic forms may constitute invaluable clues to the structure of its implicit concepts,

but to the naïve participants in the culture, those modes of evaluation are as much a regular sequence of natural phenomena as is the necessity of air, water and food for life.

Every good way of life, then, is a structure: not a haphazard collection of physically possible and functionally effective patterns of belief and action, but an interdependent system whose influence is greater rather than less because the fundamental premises and categories are seldom brought into the realm of explicit discussion. Some degree of internal coherence which is apperceived rather than rationally constructed seems to be demanded by most of the participants in all cultures. As Whitehead has remarked, human life is driven forward by its dim apprehension of notions too general for its existing language. Such compulsion may well be the same urge for conformance to form and pattern which appears to be a property of all nature, exhibiting itself on all levels, though perhaps most obviously on those which are simplest. For instance, when a crystal is dropped and broken, its divisions are neither random nor chaotic, but follow a pattern which is predetermined by the structure of the particular crystal.

In this connection, Cassirer and Lewin have noted a very interesting point in intellectual history. One of the significant landmarks in the history of any science is the order of phenomena which this science at a particular time recognizes as real and legitimate subjects of study. Under the influence of behaviorism and positivism, the so-called social sciences have been rather reluctant to grant the same degree of reality to forms that were granted to events, objects, statistical distributions, and so on. It is nevertheless true, as all philosophers know, that relations and forms are essentially real. A very simple example will demonstrate this.

Let us suppose that we have a brick wall, to begin with, and that I then remove it, brick by brick. If I am a consistent positivist, I am compelled to say that nothing has been destroyed, for the bricks still remain. We can carry the illustration even further, and completely pulverize the bricks without admitting that we have destroyed anything, for the matter remains. Yet the wall no longer exists, because the form is gone.

One of the interesting things about cultures is that their form has a tendency to persist far longer than their content. Acute historians have been able to record the inescapable concepts of certain cultures by inspection; although the content had altered radically over a period of time, the container, as it were, remained somewhat the same.

Because this is so, we must recognize that we are now in what Warren Weaver calls the realm of organized complexity. Weaver says — and I think he is entirely right — that the history of science has three phases. First there is the phase wherein a science like physics is able to deal with problems of ordered simplicity — with the mechanics of three billiard balls on a billiard table, for instance. Then the science moves into the realm of disorganized complexity, which might be represented by fifteen million balls on a billiard table. Here the problems of probability of random events, and of certain types of distributions are the concern, neglecting the individual act or event. Then, finally, there arises the problem of organized complexity, where the question is not one of measurement in the ordinary sense — not a question of so and so many units, such and such sequence and intensity — but rather of what point in what pattern.

To illustrate: organic chemists have, in the last generation, discovered that the same matter, with exactly the same atoms in constituting molecules, can form two separate compounds. The only difference lies in the fact that the atoms of one molecule are arranged in a certain pattern, and in the other molecule the pattern is formed in another way. This apparently slight variation is enough to make one substance nutritious and the other poisonous.

Because cultures have this organizational property, it becomes necessary to discover the terms in which they are organized. What is the least common factor? What is the underlying principle or element in terms of which this order or that is achieved? Some brief examples from the Navaho culture may be helpful in answering these questions.

An anthropologist (or anyone else who is systematically and with some detachment studying a way of life) observes what people do, hears what they say, examines the objects they have made, and studies the alterations they have effected in their environment. He then finds that there are certain regularities in these events, whether in the verbal realm or in the realm of overt action. Events are not randomly distributed, but rather fall into patterns. For example, modalities of both action and ought, or preference, statements occur. Actual behavior and ought statements at times coincide very closely and at times are almost completely at variance, dependent largely upon the speed of culture change.

In the Navaho culture there is a behavioral pattern — a modality of action — in accord with which a medicine man, when teaching an apprentice for a fee, never quite teaches everything. Clinical observation and hearsay, in such a case, both demonstrate that the normative pattern is identical. This structural regularity occurs as the first order of abstraction. If a quite different area of content is explored, one finds the same thing. In rug making, and in the making of baskets, pottery, etc., the Navahos always leave

a design unclosed. It is loosely called a "spirit outlet." Here again the normative and behavioral patterns are the same. You will also find that it is neither an ideal nor a practice from the Navaho point of view that complete intimacy should be achieved in marriage. The husband must hold back a little, the wife must hold back a little — not sexually, but in knowledge and "spiritual things." These instances are of the first order of abstraction, but in all of them there is a highest common factor which we can generalize: fear of closure. This is a concept. You must realize that this is an interpretation by the observer, for no Navaho ever talks about such things. But it is there, none the less.

This is an example of what I call a configuration or theme of Navaho culture. It is part of the structure of their implicit culture. We cannot stop there, however. The concept is not understandable unless one comprehends the Navaho picture of the physical world, which is conceived as a kind of harmonious dynamism that is constantly threatened by completion. And completion is to them annihilation in the deepest sense. Thus the theme of Navaho culture which we generalize as the concept fear of closure is comprehensible only by reference to this still higher abstraction. Ten or a dozen other thematic principles similarly built upon normative behavioral patterns could likewise be shown to be fully understandable only in the light of their underlying conception of the nature of fundamental reality.

This sort of thing occurs also in another aspect of implicit culture, namely grammar, morphology. This has been brought out in several papers by Professor Hubert Alexander, as well as in a series of beautiful papers by Mr. B. L. Whorf. I should like to give some examples — partly theirs, partly mine — to show how in linguistic morphology the underlying, primitive categories and conceptual assumptions of the culture are crystallized.

Let us consider, for instance, the time system. Although we are often unaware of the fact, in our language we constantly put events in a certain kind of time sequence. In Navaho, however, the tense system is very slightly developed, although more so than in some closely related languages. What counts to the Navaho is the type of activity. Whether the act occurs before or after or in the future is unimportant; what matters is, are you beginning to do it? Are you ceasing to do it? Are you continuing to do it? Do you do it now and again? And fifteen or twenty other of these activity categories which linguists call aspects.

The Hopi language, which was analyzed by Mr. Whorf, affords still a different view of what is important. In Hopi the emphasis is on the type of information. Are you merely reporting an event? That is the first kind of differentiation that must be made. Are you quoting someone? Are you saying something expectable because it is customary, or are you displacing the old authority for the statement?

This type of differentiation is still more fully developed in the Wintu language, described by Dorothy Lee. The Wintus must at some time in the past have been obsessed with epistemology, for their language is extremely precise. For instance, if I want to tell you in Wintu that Harry is chopping wood, and I have personally witnessed the event, I say one thing. If, however, I have been told by Harry's wife or some other reliable informant that Harry is chopping wood, then I must use a different expression. On the other hand, if it happens that I can hear the sound of chopping and I know that Harry ordinarily chops wood at this time of day, or if I saw him a little while ago carrying an ax, then I have to say something still different to show that I am making an inference. But if I make a still more extended inference — if I haven't heard any sounds of chopping or seen any chips flying, and if I haven't had a report on Harry's activities from a reliable informant, but merely know that Harry is a regular worker who chops wood at this time every day — then yet another form is obligatory.

This is another illustration of how points of emphasis depend upon certain usually implicit judgments as to what is fundamental out of all the possible distinctions human beings can make in reporting their experience and in trying to organize their lives.

I should like now to turn to one special aspect of this general field which seems to me to be of fundamental importance as far as general education is concerned. This is the problem of values. It is a commonplace to say that the crisis of our times is the crisis of values, but the fact that it is commonplace makes it no less true. As Whitehead once remarked, "We're living in the first stage in human history in which all over the world it doesn't work very well to live strictly in accord with the solutions which other people have worked out for us." For the first time in human history this situation is essentially universal. A series of events has threatened the foundations of most of the major values in the world. New problems have been created by rapid communication and industrialization. It is no longer just a small group of philosophers and anthropologists who realize that there are different kinds of value systems. All of us are faced with the problems created by this fact.

There have been, of course, a series of intellectual movements which have tended to bring about the present crisis. Some logical positivists, for instance, solemnly proclaim that the statement "thou shalt not kill" is meaningless. Wittgenstein says, "Ah, values — that is a terrible business. The best you can do is stammer when you talk about it." When statements of this kind,

bearing some current prestige, are diffused among students and in the world at large, they make for an untrammeled, completely rabid relativism. The Marxists, of course, have done their share to weaken the authority of traditional values — indeed, of any values except as sheer epiphenomena, verbal rationalizations after the fact. Psychoanalysts have also contributed to the confusion. Through a form of vulgarization of Freud's thought, popular opinion believes that his advice is something like this: "Conscience is a tyrant. It gets personalities mixed up and distorted. The best thing you can do is get as much freedom as you can from your conscience." Anthropologists too have talked about such things as "co-existing and equally valid forms of life." Of course, if such a statement is taken literally, it means that Nazism is justified and that slavery is legitimate because it is still practiced by a certain tribe in Africa. This untrammeled cultural relativity must take a good share of responsibility for the situation in which we find ourselves at present. In addition, the competition and disagreement among Christian sects has tended to weaken the authority of all churches, so that many modern men, at least in the Western world, tend either toward purposeless hedonism or toward an explicit or implicit theory of relativity as far as values are concerned. Many of us feel, as Paul Valery said, that instead of sitting down to play an honest game of cards with destiny we are in a game with no rules; what is in our hands will change in a moment, and we have no way of knowing whether the cards in our opponent's hand came out of the deck in front of us or out of some completely haphazard combination of circumstances.

Because of all this, general education, by and large, is neglecting its most important responsibility to society. It has avoided a consideration of values because they aren't scientific — a scientist doesn't talk about values. "Science gives you a car and chauffeur, but it doesn't tell you where to drive." (All this intellectual folklore which dates from the dichotomy between the *Naturwissenschaften* and the *Geisteswissenschaften*, and which Mr. Northrop has so brilliantly debunked, does not in actual fact have any scientific underpinnings in terms of present knowledge.) Or have educators evaded the question of values or dealt with it half-heartedly for fear of stepping on someone's toes? I am myself a teacher in a state university, and in my class I have Catholics, Baptists, Mormons, Methodists, Christian Scientists. So no doubt the only safe thing for me to do is not to say anything at all about values, because I might offend somebody and this is contrary to the spirit of our democracy.

I should like to quote a few sentences from what Eldridge Sibley says in an essay on general education, which appeared in the *Journal of General Education*: "In our complicated and secularized world, there are neither encyclopedists who can marshal all knowledge nor priests who can speak definitely on all questions good and bad. To most Americans no church speaks with unquestioned authority on all aspects of life. Each individual is his own court of appeal on questions of value. He may exercise his judgment either directly or indirectly by choosing whose opinion he will accept.

"In such a situation general education must not only develop its students' capacity for intellectual understanding, but must also help them to weigh the aesthetic and ethical values of life and to pursue them through life's changing circumstances, to pursue through ever changing circumstances goals which will make it meaningful and satisfying. General education is not successfully discharging either of these responsibilities, the older one of making the world intellectually comprehensible or the newer one which has developed upon them through the decline of dogmatic religion."

We not only have a clear practical duty as educators to give honestly what direction and persistency we can on matters of value, but also, as people engaged in research, we have a categorical imperative to make some exploration in this field. Why must we study values? It is because we cannot understand human behavior unless we study the basic conceptual assumptions of which values are a very important part. We must look at the human species from the point of view of the natural historian, in order to make certain propositions that will hold true for the whole species. One conclusion that is forced upon us by an examination of the human animal is the fact that he is an evaluating animal, always and everywhere. Moral standards may vary greatly among different cultures, but moral standards of some kind always exist. This is a fact that many of us seem to have overlooked. If human beings had shown themselves capable of an existence like that of other animals, I'd be more willing to dismiss this whole problem with James Joyce's phrase: "I fear those big words that make us so unhappy." But scientists as well as other human beings know by introspection that although our behavior may not always follow standards, it is always to some degree influenced by these standards.

One finds in literature some curious and interesting statements which describe the potency of this influence. In Proust, for instance, there is a magnificent passage on the death of Bergotte. We tend to think of Proust as a "decadent" Frenchman, yet we find him saying something like this: "There is nothing in our earthly condition to make us think that we are under an obligation to be good, morally sensitive, even to be polite. All these obligations which have no sanc-

tion in our present life belong to a different world, founded on goodness, moral scruple, sacrifice, a world entirely different from this one." Then there is Sartre's story of the man fighting in the Spanish Civil War, who finds himself in a situation where he can save his own life, and the lives of some people he loves, very simply. All he has to do is betray a friend. He doesn't do it, and Sartre comments on "the absurdity of existence." The absurd fact that a hero will not betray his friend even when lives are at stake is indeed obvious. Yet, says Sartre, human beings are like that. It is the nature of the beast. I maintain that it is a natural scientific fact that our behavior, while seldom or never completely determined by standards which transcend our own situation at the time, is somewhat dependent upon those standards.

There are thus some universal values, I must repeat, which are found in all cultures. It is a myth to say that morality is solely determined by each different culture. This is no more true of morality than it is of standards of mental normality than it is of standards of mental normality — although some psychiatrists under the influence of a not very mature anthropology promoted the theory for awhile. There are also other values which I think are properly local in space and time. There should be variations to correspond to differences in individual temperament consequent upon our varying biological inherences, to different natural resources, to different situations, to differences in historical background. But I agree entirely with Professor Northrop and Professor Margenau that there are reasons as well as need for thinking that by scientific means something can be done to hasten the re-emergence of universal values. Mr. Northrop's point that the underlying primitive postulates and primitive assumptions are not discordant with natural science knowledge is very important. This does not in the least imply that Darwin's theory of the origin of the species should be construed to mean "survival of the fittest." What Mr. Northrup suggests, I think, is not that one derives moral principles from natural science values, but rather that the most basic assumptions of a value system must be in accord with human nature and with nature in general, as known by the natural sciences.

It is my belief that anthropology can contribute specifically to this integrative problem. If we find (as we do) that in spite of tremendous variations in other respects there are some moral principles that appear in every society, this must correspond to some inevitable necessity of human nature or to the gives of human existence. Thus we have real evidence for believing that there is a way — which I don't pretend to see other than vaguely — between the annihilism of untrammeled relativity and the absolutism of all forms of authoritarianism.

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# CELL AND PSYCHE

## The Biology of Purpose

## Edmund W. Sinnott, Yale

(University of North Carolina Press, 1950, $2.00)

### A REVIEW

The mathematical physicist, Ernest Schrödinger, asked a question in the title of his small book, *What is Life?* (Macmillan, 1947). He answered by saying, in effect, that physics does not supply the truths which mechanists require. His remarks might have led to a response from neo-vitalists, but Professor Sinnott avoids this pendulum swing. He argues, in sum, that bodily life and purposeful psyche are two parts of one whole. This unity appears in the cell. At the human level the psyche displays special higher qualities, and also, of course, higher organization.

The parallel to a deeper unity such as was found in relativity between the two aspects of mass occurs to one's mind. If, then, function and form are parts of one whole, in what does the unity inhere? Present field theories do not satisfy Mr. Sinnott.

In the brief compass of his McNair Lectures, the author of *Cell and Psyche* manages with remarkable comprehensiveness to refer at least to all the major kinds of scientific explanations. He even admits the possible cogency of the mechanist answer for low levels of life, but he counters on two points: Mechanism is not the only possible answer, and for man it is inadequate. He requires us to confront organization as a basic datum. The existence of this "unsolved problem at the very core of biological sciences" is required to make us seek for the new concepts and principles we need if we are to make proper answer to Schrödinger's question.

This is a valuable manual from a mind which has matured while biology itself has grown so wonderfully rich. The reader comes away with the feeling that three centuries of dispute in biology may be about to have an end in a new insight.

Certainly the MacNair Lectures sustain in this volume the high quality offered to us by Kirtley F. Mather last year in his *Crusade for Life* and by Hocking, Compton, and others in the preceding twenty volumes.

F. L. K.

# THE PLACE OF CHEMISTRY IN THE INTEGRATION OF THE SCIENCES*

Linus Pauling

California Institute of Technology

In attacking the problem of the integration of the sciences, I feel that I must speak with considerable diffidence, since all that I shall attempt to do is to present a few reflections of my own experience, with the hope that they will be of some general interest.

I think that everyone would agree that it is desirable to have integration in the sciences. By this I do not merely mean that the tools and methods of one science should be available to another. This is not enough. It is true that the use of physical apparatus by chemists, or physiochemical methods by biologists, helps to make progress. You remember that when Kirchoff invented the spectroscope eighty years ago, his friend Bunsen immediately used it to discover cesium and rubidium. And more recently, as soon as the cyclotron was invented chemists in Berkeley and elsewhere began using the artificial radioactive materials it produced in the investigation of chemical reactions. Examples of this kind prove that physical techniques discovered in one branch of science have significant value in the solution of problems in another branch.

There is, however, another type of technique which would be of even more assistance if we could make the transfer from one science to another, and that is the technique of thinking. It is in this area that a great deficiency lies, and I myself am not sure how it may be remedied. The physicists have developed the ability to concentrate in a useful way on the theoretical problems of physics. They have specialists who do nothing but think, leaving to others the job of carrying out experiments and collecting useful facts. Every time a new discovery is made, theoretical physicists all over the world cooperate in trying to fit it into our present body of knowledge. This effort to relate new facts to what is already known is not made so intensively in other sciences. Individual investigators in the fields of biology and medicine sometimes make such an effort, but in a rather desultory way, so that the consequences of new discoveries are perhaps never thought out, or at least not for many years.

I should like to give an example chosen from my own experience to illuminate these points. I am a chemist by training and inclination, but as part of my preparation I studied theoretical physics, and later I became interested in biological and medical problems. After I had begun to work in the biological field, I met Dr. Karl Landsteiner, the great serologist, and for several years I had the benefit of occasional discussions with him of the relation between immunological reactions and the structure of molecules. During the course of our discussions I began to realize that there was a great difference in our ways of thinking about problems. He knew all of the experiments that had been carried out in this field, and when I asked a question about a point, he could tell me what experiments had been done that bore on it. He would say that some of the experiments indicated one thing and some another, and would end with the remark that no fixed conclusion could be drawn. Often I would ask a question and he would reply, "There are no experiments that require rigorously that one answer or another be given to this question." In short, he was unwilling to accept an idea about serology until the experiments were absolutely conclusive. Because of my contact with theoretical physicists, however, I had the habit of looking for a speculative idea that would clarify the situation, whether or not the idea could be proved rigorously. Although Dr. Landsteiner was surprised by this procedure, we continued our discussions, and finally were able to compress the great body of factual material of serology into a homogeneous theory of the nature of serological reactions — a theory which is not proved rigorously but which, if accepted, clarifies the field.

This is an example of the kind of integration between the sciences which involves the transfer of the ways of thinking used in one science into the field of another.

The objection may be raised that it is difficult to make such transfer in an effective way because of the complexity of our body of knowledge. Teamwork alone cannot solve the problem, for the integration needed is primarily that which takes place in the mind of a single man. Comprehension on such a scale may seem to be a wellnigh impossible task — one that would need the universal genius of a Leonardo da Vinci. Yet I believe that the evolution of science toward simplicity will make integration possible of achievement by ordinary mortals like ourselves.

I suggest that the evolution of a science proceeds through three stages. In the first stage a science is quite simple because it does not encompass very much. This is the stage of amassing facts from experiments: when only a few experiments have been carried out the number of facts

*An address at the Montecito Workshop, August, 1949.

established is not too great for one man to comprehend. The individual scientist can then know the whole of his science thoroughly and have a considerable acquaintance with other sciences as well. However, as time goes on and more and more experiments are performed the number of known facts becomes greater, until finally they are so numerous that to master a field becomes a full lifetime's work. It is only after a science has passed through this stage of great complexity that the third and final stage can be reached. I think that it has arrived in physics and is not far away in chemistry. This is the stage of simplification, when in order to master a subject it is not necessary to memorize the results of all the experiments that have been performed, but only to learn the fundamental principles that encompass all of these results.

When a science has reached this stage, it is no longer necessary to test all of its facts by experiment in order to understand it. W. Pauli mastered theoretical physics at the age of eighteen so thoroughly that when the editors of the *Encyclopedia Mathematica* looked about for a man to write an authoritative article on the theory of relativity they decided that Pauli was the man to do it. I have been told that once when Einstein gave a talk on the general theory of relativity an eighteen year old youth in the audience (Pauli) rose and said that he agreed with the speaker on all points except two, and then mentioned these two point of disagreement. Physics — or at least that part of physics encompassed by the theory of relativity — had progressed to this period of simplification. (The theory of quantum mechanics had not been developed at that time, but Pauli also understood quantum theory thoroughly and contributed to the development of quantum mechanics.) When chemistry and biology reach this stage it will be possible for an ordinary scientist to be master of more than just one branch of one science, such as organic chemistry.

I am encouraged to believe that this time is fairly near at hand, and that we shall soon have effective scientists who can cover a broad field. This does not in the least mean that their science will be less sound. I read an article recently in *Science* which stated that a certain university proposed a source of training for broad integrative science. This consisted of one year of general elementary chemistry, one year of biology, one year of mathematics, one year of physics, one year of geology and one year of astronomy, after which the graduate was to go out into industry and act as an integrator — a scientific generalist! Frankly, I think such an idea perfectly horrible. How could a man of that sort be any good? Who would have confidence in him? If we want to have a real scientific generalist, he must be trained by mastering one field of science and then spreading his mastery over other fields. Such a man would, of course, have to be better than average.

Perhaps the next thing to consider is the best field on which to concentrate before the scientist attempts to broaden his area. I feel that it would not be adequate for him to be a master of semantics, for example, or a master of sociology, or even a fine theoretical physicist. What he should do is become a master in the field of chemistry, and especially, I might say, of structural chemistry. This is of course my own specialty, and it might be said that anyone who views this problem will feel that the field in which he himself has studied offers the best preparation for general scientific knowledge. Nevertheless, I should like to defend my nomination of structural chemistry.

It seems to me that theoretical physics would not serve because it does not give a complete understanding of the physical world and the biological world. Physicists in general tend to restrict themselves to the small part of the physical world with which they deal, and to leave out of their studies all such features as the structure and properties of substances in relation to their chemical composition, and the reactions that change one substance into another. A physicist is interested in mass, energy, inertia, and so on, and he is not much concerned with what substance is involved in the display of these characteristics. It happens that nuclear physicists have become chemists, because for this branch of physics the nature of the matter under investigation is of special importance, but in general physicists are rather deficient in knowledge of the chemical properties of the physical world.

Chemists, however — and biologists also — are interested in the different kinds of matter, not only in the form of substances but also in their more complicated aspects, the objects that are built out of the substances. The idealization the chemist makes is that he is interested in the material substance rather than the object: in, let us say, steel, no matter if it is made into an axe head or into a bottle opener. But the biologist is interested in the shape of particular specimens of protoplasm, whatever protoplasm is. It is the objects themselves that constitute living organisms, and living organisms, and their parts, interest him. His interest includes chemical composition and physical properties. If the biologist explored the whole field thoroughly, so that he understood the chemical composition, the properties of chemical substances, and the physical properties of chemical substances, he would be a universal scientist himself. But the biologist sometimes is deficient in knowledge of the fields of physics and chemistry. A good chemist, on the other hand, must have a sound knowledge of physics as well as of

chemistry, and this general basic understanding of the physical world can be used in expanding in such other directions as are necessary to contribute toward the integration of the sciences. He can move into biology and build upon his knowledge of chemistry the additional biological structure needed for some understanding of the biological field, or he can move elsewhere, as into medical research. It is of course possible for a physicist to go into general science also, if he has first a fairly good understanding of chemistry.

Perhaps I should substantiate my claim that a well-trained chemist — especially a structural chemist — has the best chance of contributing to the integration of the sciences. The structural chemist is primarily interested in how the properties of substances are determined by the ways that atoms are arranged together in molecules or larger atomic aggregates. This makes him peculiarly able to contribute with profit to integration. The whole problem of understanding science is, I believe, the problem of relating facts to the concept of structure, first in terms of atoms and then in terms of something still smaller, such as nucleons. Eddington once said that the investigation of the physical world is a search for structure and not a search for substance. It is structure that we look for whenever we try to understand anything. All science is built upon this search: we investigate how the cell is built of reticular material, cytoplasm, chromosomes; how crystals aggregate; how atoms are fastened together; how electrons constitute a chemical bond between atoms. We like to understand, and to explain, observed facts in terms of structure. A chemist who understands why a diamond has certain properties, or why nylon or hemoglobin have other properties, because of the different ways their atoms are arranged, may ask questions that a geologist would not think of formulating, unless he had been similarly trained in this way of thinking about the world.

Let me illustrate again from personal experience. A long time ago, in 1934, after having worked with simple molecules for some time, I began to be interested in the structure of hemoglobin. These complicated molecules in the red cells of the blood consist of about 10,000 atoms, of which four are iron atoms. It seemed that each iron atom must be able to pick up an oxygen molecule, since the hemoglobin molecule, containing four iron atoms, can pick up four oxygen molecules. As oxygen is paramagnetic when free, but diamagnetic in compounds, my associate, Dr. Coryell, and I thought that we might answer the question of how the oxygen molecule hooks on to the hemoglobin molecule by seeing whether the oxygen retains its paramagnetism after it is taken up by the hemoglobin. By use of a magnet and a balance we found that the oxygen lost its paramagnetism in arterial blood; but we discovered in addition that the iron atoms, which in the hemoglobin molecule in venous blood are themselves paramagnetic, also lost their paramagnetism in arterial blood. This is direct proof that the oxygen is picked up by the iron atoms. The magnetic properties show clearly the structure of the complex of iron atom and neighboring atoms in the hemoglobin molecule before and after oxygen hooks on to the iron atom.

About three years ago I began to be concerned about the disease called sickle cell anemia. This is a fatal disease that affects negroes almost exclusively. The red cells of a patient suffering from this anemia experience a characteristic change in form. Instead of being flattened spheres, they change into sickle shapes, become sticky, and adhere to each other. This process occurs only if a large fraction of the hemoglobin is not combined with oxygen or carbon monoxide.

I felt that this deserved further investigation and began work on the problem with a young M.D., Dr. Harvey Itano, who came to study with me. It was found that patients with sickle cell anemia have in their red cells a hemoglobin that is different from ordinary hemoglobin — a new form of hemoglobin. This is the first time that any adult human beings have been found without ordinary hemoglobin. If in the course of time we can trace the difference between this molecule and the molecule of normal hemoglobin, we shall have a complete understanding of the nature of this disease. It will then be unique in the annals of medicine, for I doubt that there is any other disease of which physicians have complete understanding.

This example shows an integration between the basic sciences — electromagnetic theory, the magnetism of the hemoglobin, structural theory, and so on — and another complicated field, medicine. Sooner or later such integrations will become common.

I should like here to say a word about integration of all the sciences, including the social sciences. Everyone realizes that a closer relationship between the social sciences and the natural sciences would be a wise and splendid thing, but I myself do not know how it can be achieved. The National Research Council is giving special fellowships to people with training in the social sciences to permit them to work for a year or two in the physical sciences, and to people with training in physical science to work in social science. This process of cross-fertilization will be especially valuable for the social sciences; perhaps the physical sciences will derive some benefit also, but I am not too optimistic about it.

I myself feel that the best way in which the basic sciences can be of help in the solution of our great social and political problems is through the process of education — assisting students to learn what the scientific method is, and encouraging them to use it in their thinking generally. An understanding of physical laws would be useful in attacking social and political questions, and would undoubtedly aid by leading to better decisions in these fields. A physical law is a succinct description of the results of a number of experiments. It is not an inflexible, unchanging dogma. It describes only the experiments that have been carried out up to the time the law is stated. We have Newton's laws of motion, based on such facts as that all objects dropped in a vacuum take the same length of time to reach the ground. Physical laws, however, are always subject to change. Newton's laws turned out to be only approximate after the Michelson-Morley experiment had been carried out. When the experiments that constitute the basis for the theory of relativity had been made, the exact laws were seen to be Einstein's equations of motion. Even those, of course, are not exact laws in the field of the very small, where quantum mechanics is involved, and it appears that something more is needed for exactness in nuclear dimensions.

It seems to me important that the student should understand that these basic laws of nature may, as a result of some new experiment, not be exactly right next year. Trained in such an attitude, the student may not be taken in so easily by bald statements about social and political questions, but may reserve judgment, regard such generalizations as without sufficient basis of evidence, and insist on doing his own thinking. There is always the chance that if we try something else, some new idea, it may prove to be closer to the facts. It is often true, in the field of politics, that the dogma currently in favor is something that has worked well once, and therefore is continually supported, even though it may no longer be useful.

I believe that the greatest contribution that science can make to other disciplines is the inculcation of the scientific attitude — the reliance on fact, not dogma, and the habit of flexibility of mind which this engenders. It is not too much to hope that science may in the long run affect man's nature as well as his habits. Benjamin Franklin said, nearly two hundred years ago, "The rapid progress true science now makes occasions my regretting sometimes that I was born so soon. It is impossible to imagine the height to which may be carried, in a thousand years, the power of man over matter. Oh that *moral* science were in as fair a way of improvement, that men would cease to be wolves to one another, and that human beings would at length learn what they now improperly call humanity."

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# EXPERIMENT IN NEW JERSEY

A. Gordon Melvin

College of the City of New York

*This is the first of a series of news reports on major and notable examples of modern college practice. Similar accounts of work in other colleges which come to the notice of the editors will be published in later issues of* MAIN CURRENTS.

A startling example of modernized method in general education at the college level was carried on during the past term as a seminar in the arts and sciences at the New Jersey State Teachers College. The opportunity was provided by an unusual and transitory group of veterans, who were given a large block program cross-cutting the total areas of both arts and sciences. President Forrest A. Irwin seized this chance to avoid, with this special group, and for the duration of the experiment, the subject division which so seriously hampers the modernization of college programs.

Instead of the standard classification into subjects, a new plan was used. The total program was centered about human activities, and developed into a series of informed inquiries into man's relation to (1) his physical environment, (2) his fellow men, (3) himself and his inner nature, (4) the larger universe in its cosmic aspects.

The group was conducted as a seminar by Dr. Norman W. Beck, and Dr. Grace Taylor, both

of whom gave full time to the work. The full faculty of the College was associated with them, and their cooperation is an excellent example of the way in which liberal minded educators can work together in new orientations. The term "seminar" was interpreted in a broad fashion as a democratically organized group of students working together. They first developed a program in the large area of arts and sciences, and then implemented their decisions by action and extensive study.

Much of the secret of the success of this imaginative venture lay in the skill used in organizing the total project. The measures used included: (1) A student group in which each person was recognized as an individual; (2) A series of proposed activities; (3) An intricate class organization, with special duties for all; (4) An investigation of student interest and talent; (5) A dated calendar of events; (6) A program of studies supported by specially designed bibliographies.

The plan operated somewhat as follows:

In the beginning of the term each student was presented with a mimeographed name list on which to enter his specially chosen responsibilities. During the discussion in successive meetings, various activities and responsibilities were proposed. Individual students then volunteered to take on these special activities and responsibilities. The organization finally included a chairman, a recording secretary, a librarian, a bulletin board secretary, an activity planning committee, a program planning committee, a group of curriculum representatives, and a committee on evaluation. With this organization established, the class went into high-powered action, developing a program of study, action, and discussion of outstanding merit. The complex activities were kept in order by use of a calendar.

A special program for each individual student was arranged. This was done after a careful study of student interests and special abilities, and by individual personal conference with one of the teachers. As a result, each student accepted the responsibility of making a report of some significance to the whole group. Throughout the study and reporting the teachers gave careful guidance as to content, method of work, sources for study, and standards of accomplishment. Therefore no student was ever left to flounder, because personal aid was always at hand.

The program which evolved was too complex for detailed report here. Those interested should write directly to Dr. Norman W. Beck, New Jersey State Teachers College, Jersey City, N. J. Special features of the term included musical programs of a high order, also many special lectures by noted visitors, including F. L. Kunz of the Foundation for Integrated Education, topical lectures by members of the larger college faculty, field trips to such varied places as the New Jersey House of Assembly, the Merck Laboratories, and the Museum of Modern Art in New York. Each member of the seminar rendered an extensive report, giving the group the result of his own studies in his field of special interest. These reports varied widely in their nature, including such topics as urban planning, personnel management, traffic control, psychology of accident prevention, appreciation of music, the actuarial method, understanding of one's own marriage, entering the teaching profession, and man and the atom. In addition a number of panel discussions were held on such topics as the pursuit of economic security, personality adjustment, man's relation to the ultimate. In the course of these activities the students accomplished a prodigious amount of reading and study and were taught a vast amount of valuable data and significant principles.

Finally, the committees on standards and on evaluation made unusual contributions. The standards set were high, including punctuality in attendance and in finishing work. Form and content were to be maintained on the highest level, and adequate preparation in terms of time spent and quality of the work done were made essential. Evaluation included the customary satisfactory scholarship, but in addition concerned itself with delivery and poise as a speaker, quality of discussion, organizational ability, and success in securing the cooperation of others. When the total results of the term were finally reviewed in terms of the original program for securing a better understanding of man, the wide scope of the program became evident. Teachers and students alike agreed that the term's work had been remarkably vital, and, to a unique degree, full of learning.

# SOME ELEMENTS FOR THE SYNTHESIS OF A CONTEMPORARY CULTURE

Howard Lee Nostrand

University of Washington

[These pages conclude the summary of the central ideas developed in an informal seminar begun in 1941 at the University of Washington, devoted to problems natural to a research for synthesis.

In the first installment the author discussed (1) the method pursued to establish a working agreement, and (2) conclusions reached about man's nature and cosmological situation. Here he reports (3) the findings on values.

In order to serve the purposes of the discussion by correspondence, invited in this issue of MAIN CURRENTS (Page 120) by Professor Hornell Hart, the previous and present installments have been made available in reprint form, and single copies may be had upon request from the Foundation for Integrated Education, 220 East 42nd Street, New York 17. The type will be kept standing for a few weeks for re-runs of quantities.—Editor]

The most dissimilar cultures show wide areas of common values, thanks to identical underlying needs and aspirations. Among the differences in values, many do no harm: the Occidental can strive to distinguish himself, and the Oriental to efface himself, without getting in each other's way. Where values do conflict, however, the clash is likely to spread from theory to action, since values are the spearheads that bring to bear the force of thinking and supposed knowledge upon conduct.

Where different values must be reconciled, the possibility of agreement rests on the postulate that the realization of human value should be maximized — a proposition apparently undisputed by all humans who have chosen to remain alive. Beginning from this postulate, one can proceed to establish that generosity is better than selfishness, and to derive the immensely various alternative forms of self-fulfillment, with their advantages over one another for this or that set of local conditions.

Agreement on human values therefore calls for prior agreement on rational method and on any propositions of fact that come into question. It fortunately does not involve the vast and disputed territories of theology and cosmogony. The only points where the discussion of values needs to touch metaphysics are the six minimum postulates, which appear to be almost universally acceptable.

In sketching out this area of a modern synthesis, let us try to answer three difficult but fascinating questions. How does scientific method as we have defined it apply to the establishing of values? Can we agree on any basic human values? If so, to what extent does this help us to agree upon instrumental values — those practical decisions on next steps, where we cannot "agree to disagree"?

Today we find general agreement that value concepts play an important part in behavior, and this agreement paves the way for a common rational approach. No longer do we have to include in a working synthesis the nineteenth-century reductive materialism which sought to explain behavior in terms of force parallelograms and could find no point where such intangibles as humane ideals could enter the real world. Nor do we have to reckon with any very live concern such as the idealists and fundamentalists felt at that time, to divorce values from all material and utilitarian considerations.

We do disagree over the question of where values come from. This is one of those matters of final cause which lie outside a working agreement because no evidence has been advanced that persuades all reasoning individuals. Some find it natural to think that values are revealed to us; others, that we gradually discover values which have antecedently existed in a purposeful universe; and a third group, that values emerge and evolve through a process of creative evolution. Within this third group some find it most plausible to conceive that values emerge only at the human level, and others, that values emerge wherever the experiencing self of any animal faces the problem of choice, or at still lower levels of the biological or physical world.

Yet all three groups agree on the worth of striving to understand more fully the precise nature of the good. As far as a working agreement is concerned, they disagree only as to whether the effort to understand constitutes our *sole* source of knowledge about values, or only a supplement to revelation. The revelationists concede that revelation needs this supplementing, for unless we strive to do our best, human imperfection may misapprehend even divinely revealed truth. The naturalists who look solely to historic trends as the basis for establishing values admit that trends conflict, and that not all trends are desirable. Thus both of these groups, as well as the middle group of rational idealists, engage in analyzing the good: and they all use the same method of observing actual situation and gradually refining value judgments. Though many thinkers may be antagonized by the term "scientific" applied to values, they do none the less use the reasoning method which we have described and which we have identified, perhaps not improperly, as a form of scientific method. Since we all agree in practice upon this reasonable approach to our problem of making

and applying propositions about values, we can safely agree to disagree about the ultimate nature and sanction of the judgments we make.

When we look beneath a surface confused by a diversity of terms, we find wide agreement, in our culture and apparently in all the other cultures of our times, upon two basic human values of individual self-fulfillment and social justice. A modern synthesis must bring together, first of all, the elements of these two basic concepts that already meet with common acceptance. From there the synthesis must go on to examine the great ideological schism of our time over the proper relationship between individual and collective purposes. At that point we must inquire what elements of our two basic values are really involved in the ideological conflict, and how that conflict can possibly be resolved.

Whether one speaks in terms of a process of self-fulfillment or in terms of a goal of salvation, happiness, or good individuality, one refers to the proper carrying out of the purposiveness inherent in human nature. And however diversely individuals or cultures may go about refining the purposiveness they have in common, their self-fulfillment is bound to include some provision for the elemental human needs we have enumerated earlier.[6] There result a number of elements essential for self-fulfillment, and these extend far beyond the area of man's animal needs. Biological values are in fact woven together inextricably with the three-fold adjustment we must all make to our own nature, to the cosmos, and to society.

We can all agree that the adjustment of ourselves to our own nature requires all the objective knowledge we can master concerning the proper conditions for health of body and health of personality. And just as physical well-being serves as a means toward higher values, so the higher values serve in turn the adjustment of our lives to the humbler elements of our nature. The cultivation of the arts in their loftiest form still has a function at the animal level. For the consolation and the sheer joy of art produce physical effects of sanity, buoyancy, and alertness, not to mention conditioning ideas like endurance and enterprise, which clearly relate to man's biological resistance and his readiness to meet the challenges of his environment. The usefulness of the arts does not of course make them any the less worth cultivating for their own sake, in a spirit of pure devotion to beauty. The same holds for the sciences and philosophy, which most of us consider it good to cultivate out of pure devotion to truth. Like the appreciation of the arts and the pursuit of knowledge, the capacity to act reasonably is also widely regarded as an intrinsic good; yet at the same time rationality is a culture pattern evolved through the adaptive process of the organism as a method of self-adjustment.

A sense of humor, too, has practically universal prestige as a personality value; but it is also a means of reducing the strain of our purposiveness upon our organic self, and a means of getting along more smoothly with others. The refinement which humor has undergone since its cruel early forms illustrates how an ideal of personality may develop hand in hand with the adaptation of the organism to its environment. The gradual spread of sympathy for others, a spiritual value, has been inseparable from the development of man's skill in human relations.

No agreement is needed as to whether these elements of human self-fulfillment are good only in that instrumental sense or in their own right.

Serious disagreement does arise over a question whether the individual fulfills himself by cultivating originality or by striving to live up to a traditional ideal. This issue becomes amenable to rational treatment as soon as both sides recognize they are seeking a proper mean between two bad extremes: rigidity that endangers the tradition itself, and rash, overconfident experimentation. Good individuality must combine creative originality, satisfying the urge for self-expression, with the beauty and wisdom we inherit in the form of tradition.

The individual's adjustment to the cosmos is a matter of elemental sanity and also of a lofty personality value, the tranquil sense of being at home and at peace in the vast world beyond the feverish activity of human affairs. We can all agree upon the necessity of knowledge about the cosmos, though we cannot agree entirely upon what knowledge is true, beyond the objectively verifiable propositions which go only a step toward any final explanation. We can agree too upon the superiority of a certain respect for nature over a ruthless exploitation, though we do not agree upon the precise place or the mean between ruthlessness and the other extreme represented by Simon Stylites, who subordinated human values to the well-being of the maggots that fed on his flesh.

The seminar agreed in giving a high place among personality values to the spirit of reverence. This we may enter here as primarily an attitude toward the cosmos, though much the same quality enters into one's manner of living with oneself,

[6]All human beings have in common a few elemental needs, which furnish the basis for corresponding human values. The chief of these needs seem to be health and freedom from want; some balance between security and adventure in one's economic, emotional, and intellectual life; self-esteem and faith in some fairly immediate meaning of life; self-expression, self-development, and perhaps a need to transcend oneself; love (sexual, familial), and friendship within larger groups; recognition; and a satisfying tempo and rhythm of exertion and relaxation. As cultures come into closer contact, these elemental needs express themselves in more and more similar problems and interests from one culture to another.

where we may call it moral earnestness, and it enters into one's human relations in the form of respect for other human beings.

A number of participants in the seminar, not only religionists, considered that the group had here agreed on a spiritual value. Others held that the reasons why reverence is better than a cocky spirit or a destructive cynicism can be demonstrated in entirely human terms.

However that may be, certainly a life pervaded by a spirit of reverence and moral earnestness is essentially a religious life, whether the individual is right or wrong, confident or diffident, in his views on the ultimate nature of things. The term religion proved too complex and variable in meaning to be used, for the present at least, as the label for an area of common ground in our culture. Yet we must take care not to be misled by the absence of the word. The reader who approaches the present record of agreement with deep religious convictions of his own, whether Christian or other, will be interested to count up how many of his cardinal tenets the synthesis embraces, both in concept and in spirit.

It is undisputed that specific religious traditions have shown, by their great power of survival, how vital a need they fill in human life. It is agreed too that externalized religion, as well as the arts, plays an important role in our emotional adjustment to the best knowledge we have of the cosmos.

Our adjustment to society calls into play the personality values of friendship and affection, which rest directly on the individual's elemental need for love and companionship.

Accurate knowledge, too, is commonly recognized as a necessary means. The individual's adjustment to society depends partly on his knowing what to expect of people, of social groups, and of society in general as it evolves toward a wider and more organized community of men and nations. His adjustment depends partly also on his being able to foresee the effects of each choice he plans to make. We do not always agree, however, on how far we should go toward the bad extreme of too much analysis, which impedes decision.

The adjustment to society also gives rise to component or instrumental ideals that spring partly from the needs of society, such as honesty and altruism. In private affairs, the ideal of honesty meets with little or no dissension. On this all cultures seem practically united, though their ultimate sanction for the ideal varies from supernatural revelation to the humble observation, on which all can agree, that dishonest acts in the long run have bad effects. Applied to public affairs, this ideal has obviously yielded in the past to one of irresponsible sovereignty of the state. But it seems reasonable to hope that the interconnected global world of our time will favor progress toward that "generality of outlook" which Whitehead has identified with morality. Possibly the agreement upon the ideal of honor, at least in personal relations, will be found to go beyond the utilitarian basis and include the proposition that virtue is its own reward. That concept has certainly flourished in earlier periods of moral crisis. It figured prominently in Plato's resolution of the Sophists' enigmas, and in the Romantics' reaction against a decadent classicism.

The ideal of altruism we shall discuss later as one element of self-fulfillment involved in the conflict over the proper relationship between our two basic values. On the other hand, the objective of attempting to bring about *some* sort of good society certainly belongs among the points of common agreement. The persuasion that one should make that attempt in a rational way is less widespread; yet as we have said of the valuation process in general, the critical refinement of ideals is common to all cultures. This fact together with the influence of technology, as it increases the similarity of problems and interests from one culture to another, may be expected to bring closer together the diverse contemporary ideas of a good society.

The arts are quite as important for the individual's adjustment to society as they are in the more personal affair of his relation to himself and to the cosmos. As a consequence, it can be generally agreed that works of art need not only to express the artist, but also, to be intelligible to others. The arts furnish a rich source of experience of values; and literature particularly combines this experience directly with knowledge about values. How could we better refine our attitudes in the matter of personal honor, for example, than by experiencing the contrasting concepts of Falstaff, Hotspur, and the noble Prince Hal in the first part of Shakespeare's *Henry the Fourth*?[7] But in all the arts at their best we find the same balance of emotion and intellect, of intense experience and well-thought-out knowledge, that we see so readily in great literature.

The whole, complex ideal of good individuality has been subtly changing since the advent of modern specialization and slaveless democracy. Earlier periods have idealized as separate types the active, energetic youth, skilled usually in some specialized activity, and the mature man who cultivated universal wisdom, detached from utilitarian concerns and lonely amidst his unenlightened contemporaries. Thus on the one side we

[7]See the excellent essay on this aspect of the play by Professor Marjorie Nicolson, in *Association of American Colleges Bulletin* (May, 1941) pp. 226-234.

have had the ancient athlete, the knight errant, troubadour, and Romantic hero, and on the other the lone leader of prophetic times, the contemplative philosopher of antiquity, the medieval ascetic, and the sage of the Renaissance. The type we idealize today is no detached observer of society. We seek to combine in a single personality, for a prolonged prime of life, both mature judgment and the vigorous activity of youth. Our ideal man or woman continues throughout life to exercise some specialized skill; and at the same time, from the age of 21 to an average age of 65 or more, this ideal man or woman plays an active part in determining public policy.

The new ideal takes up the principle of rationality and seeks to apply it over a wider range of social relations than ever before — the relation of the individual to government, and to his contemporaries taken as fellow participants in a democratic electorate. The personality value of reasonableness had already grown more prominent in the ideal of the sage, between the epoch of Moses and the epoch of Montaigne. In giving this value a wider application, the emergent ideal of our time joins with other social forces that tend to make the quality more universally esteemed. Intercultural contact has brought about the rational appraisal of many an irrational belief, and scientific achievement has spread the prestige of rational method. Business, too, has made a telling contribution. Our "business man's civilization," with all its faults, does spread patterns of rational persuasion and free individual judgment into new areas. For these patterns are essential to good business, unlike the pattern of narrow selfishness which is not an inherent necessity. Alfred North Whitehead has well developed the theme that the rise of commerce has been one of the powerful factors in the gradual replacement of force by persuasion.

An exclusive emphasis on intellect and rationality would of course lead to a superficial grasp of human nature, or even of the scientific method. It would also widen the chasm between the Occidental and Oriental minds. It is one of the happy mediums vital to good individuality, that we should balance intelligence with imagination, emotion, and volition in a working harmony.

Important elements of good individuality often suffer an eclipse in one culture or another. The eclipse may not affect the actual practices of daily life nearly so much as it affects people's theories of how they behave; yet these theories do influence attitudes. Scholarship in the field of intercultural relations can do a great service by revitalizing the submerged values which cultures possess in common without being conscious of them.

The principle of rationality itself, perhaps the most serviceable of all intercultural patterns of behavior, goes unappreciated in some whole cultures and no doubt in some important traditions within every culture.

The idea of moderation — of virtue as a mean rather than an extreme — though difficult to dramatize and far from simple or constant in meaning, is an ideal with a great potential force for bringing otherwise diverse cultures harmoniously together. It is a bond of intellectual companionship that unites thinking individuals of all times and places. Apparently this salutary concept runs through the Oriental cultures as well as those of the Occident, and thus may help to bridge one of the great cultural rifts that divide the human race in our time. The East-West Philosophers' Conference of 1939 confirmed this hope. "The generally accepted conclusion was that the ethical systems of the East are many and varied and cannot be described in one word or phrase of characterization, but that, in general, the idea of moderation predominates with renunciation also important."[8]

A submerged value in the Western world since the Renaissance has been the concern with the "togetherness" of the world. In the instructive, Orient-centered view of Mr. Coomaraswamy, Europe and Asia understood each other well in the Middle Ages, but then drifted apart when Europe began its modern cycle of extroversion and preoccupation with surfaces rather than with unity, while Asia remained herself. It is just possible, he thinks, that certain trends of our day may bring the East and West once more to a mutual understanding: the trend of mathematics and the mathematical sciences to discover interrelations among systems that previously seemed isolated from one another; a corresponding concern of modern art for the expression of underlying identities; and the effort of the West to understand Asiatic thought and art, as they penetrate into the Western environment.[9]

In the national culture of the United States we can discern several submerged values, whose elevation to a worthier place would make us more congenial to many neighboring cultures.

One of these is the ancient virtue of humility. For withal our receptiveness to criticism we suffer from the sin of pride, which comes out in an unwitting appearance of patronizing those on whom we lavish our good will.

Another is a certain serenity found in those who have mastered the art of contemplation. Fortunately our contact with Latin America and the

[8]Charles A. Moore, "A Report on the East-West Philosophers' Conference, University of Hawaii, June 26 to August 4, 1939," University of Hawaii Bulletin, Vol. 19, Number 4 (February 1940) p. 7.

[9]Ananda K. Coomaraswamy, *The Transformation of Nature in Art* (Harvard Press, 1935) pp. 3-4.

Far East is teaching us what we miss of life in a larger sense, by our impatient straining after some limited sort of achievement.

Our neglect of contemplation has brought in its train the tragic failure to integrate specialized knowledge into effective wisdom, and the tragic mistake for which we must share the blame with our late enemies the Nazis, of having allowed the monster of technology to break loose from its proper subservience to human values.

Of all our submerged values, the habit of reflective attention to values is probably the one whose lack has had the most damaging effect on theory and practice. The neglect to give thought to human values has contributed to a certain coldness in some areas of our human relations. An effort to personalize these relations stands out however in the present state of our culture, in curious contrast with the effort to dehumanize our art and our cosmology. The humanizing trend appears in our educational institutions at all age levels, in our more and more informal patterns of public discussion, in industrial relations, and in the attitudes of government agencies — which in the past have patterned their human relations so much on the colorful but unsympathetic usages of the agencies charged with waging war or with parrying the selfish designs of other states.

In sum, we find a surprisingly wide ground of common agreement in our culture on the nature of good individuality or self-fulfillment; and the particularizations of the ideal which we share with other peoples promise to bulk larger than one would have dared to hope. Beyond the ground of actual agreement, moreover, lie the submerged values, which scholarship and the arts should be able to reclaim and add to the recognized common ground, by bringing them to light in the cultures that neglect them.

The points of common agreement about social justice, or the good society, are less numerous but not less significant.

Absolute social justice — identical destinies for all individuals — everyone admits to be impossible. It would be rash however to maintain that social justice is impossible in a more realistic sense: the gradual approximation of an equal and maximum opportunity for the self-fulfillment of all individuals.

This concept of distributive justice remains valid and practicable in spite of the great differences in the potentialities and desires of individuals. The aptitudes of some individuals cost more to develop than the aptitudes of others. Justice does not require that society should spend no more on the training of the physician than on that of the semi-skilled worker. It does require that the individual's fitness for training in any skill should be carefully ascertained; and this we are learning to do with an accuracy that once seemed impossible, thanks to strides during the last two decades in the field of testing and measurement.

All individuals and all peoples readily agree on the injustice of special privilege for others than themselves. Thus we may expect a persistent dissatisfaction with injustice. And to the extent that the common man comes to influence public policies, we may expect progress toward the first aspect of social justice — an equal opportunity for all individuals to share the available advantages.

The other aspect, the maximizing of individual self-fulfillment, meets with an even wider agreement than does equalitarianism. No one wants the sharing of opportunity to result in a leveling down to a common mediocrity. We all hold that a good society must aim to achieve excellence, regardless of whether we agree on the equal distribution among all social groups of the chance to share in the excellence that may be achieved.[10]

We have promised here only the central ideas of the seminar concerning our North American branch of Western Civilization. Prominent in the culture, however, is a preoccupation over the modern opposition of East and West. The seminar's leading ideas about the ideological part of that conflict seem therefore to belong in the present summary.

The difference between the two poles of ideology concerns values rather than fact, and involves a part, though only a limited part, of the two values we find basic to our own culture. The conflict centers not upon the nature of these two values, but upon their relationship. For us they are interdependent: neither individual self-realization nor social justice can be fully achieved so long as the other is constrained. For the thinkers on the other side of the rift, the two values appear to be of such unequal importance that the freedom of the individual may rightly be subordinated to the good of the state, as conceived by a controlling elite. If this is true, the pivotal ideological difference over values is a limited one, and of a kind susceptible to rational resolution. For once most of the elements of each basic ideal are recognized as common ground, the issue boils down largely to the relative efficacy of alternative means.

The chief element of self-fulfillment involved in the disputed relationship of the individual to society is the ideal of altruism. Does it harm the self-fulfillment of the individual who belongs to a controlling minority, if he uses his power to limit the analogous self-fulfillment of fellow human beings? Here the practice of statism and the theory of rugged, competitive individualism inherited from the last century seem outweighed

[10]For a fuller list of propositions defining social justice see the author's "Reconciliation of Net Worth," *Victory for This!* Lectures, University of Washington [Book Store] 1944, pp. 114-116.

by the logical case for altruism and by the older ideas of brotherly love embodied in the great religious and philosophical traditions of both East and West.

The chief element of social justice involved in the conflict is the ideal of equalitarianism. Here again the old traditions which affirmed the equal dignity of all individuals seem clearly to be gaining over the transitory excuses for special privilege such as the Nazis advanced.[11] And apart from this, we may expect the rational evidence to prevail in the long run, that the equalization of opportunity is more logical than a system of special privilege and underprivilege.

For if we accept the bare postulate that the realization of human value should be maximized, then we cannot but conclude that the total would be greatest if all individuals alive could reach the fullest development of their potentialities. We could escape this conclusion if we could show that one whole population had a higher capacity for development than another, for then we might argue that greater opportunity for this group at the expense of the other would obtain the highest total achievement. But we have no evidence whatever of such a differential between populations. Ancient thinkers escaped the conclusion by virtue of the fact that no one at all could have the benefits of high civilization unless a slave class provided the necessary freedom. But in our time we have machines to serve as slaves. We can pay wages to compensate for the undesirability of a job. We can reach the highest attainment imaginable without exploiting any person.

Social injustice is also bad pragmatically. Underprivilege, as one can easily show, creates discontent which threatens the freedom of the privileged. It breeds physical illness which then attacks the masters as well as the slaves. And it deprives society of leadership and special talents which are needed for the benefit of all.

Lastly, in contrast with these negative features of injustice, social justice as an ideal possesses a certain subtle but important power to stir people's imagination. It can induce them to dedicate themselves to a distant goal. True, the promise of world domination can arouse a fanatical zeal for a time. But that zeal thrives only on success. Adversity makes us ask whether the thing we are attempting to do is really worth suffering for. In that doubting state of mind we grow dissatisfied with a tawdry ideal, while if our ideal remains beautiful after all our efforts to find fault, we cling to it all the more firmly.

If we can come to a working agreement on basic human values and their proper interrelationship, then we shall be in a position to agree on the instrumental values among which we have to choose in everyday life. These instrumental values — the "next steps" on which we cannot just agree to disagree — are the chief ideological source of social friction. Not only do groups conflict over them, but the instrumental values conflict among themselves. To take a specific example, the protection of the individual by patent laws is found to promote the exploitation of the individual by monopolistic organizations. Or another example, the means to full employment and full use of resources is found to require measures of control that compromise freedom and distributive justice. Nevertheless most people agree that instrumental values should be chosen rationally. Even the two great ideological camps of World War II were at one on this point. We may reasonably hope therefore that a clarification of basic values, together with our efficient means of predicting the effects and costs of alternative means, will help to reduce the present degree of friction over social purposes toward a healthy state of tension.

Here we shall attempt no more than to list half a dozen instrumental values, of particular importance for the practical meaning of social justice.

We need first of all to apply the rational, experimental attitude and method far more widely than we have done so far. The bearing of this proposition on community problems — economic, social, religious — is never very difficult to discover.

As a second instrumental value, we need to seek throughout our society a dynamic equilibrium, that is, a state of balance in which motion is a factor — the state of balance of a man running. In politics this means an evolving order, deliberately organized at all levels including the international, and yet free to evolve as fast as more serviceable institutions can be found to meet new conditions. In economics, a dynamic equilibrium involves a balance among many factors, particularly between free initiative and necessary controls. Present forms of control which operate in restraint of a healthy, maximum economic activity, such as tariffs on foreign trade, must be gradually removed. Indirect controls are in general preferable to direct controls, provided they strike at the real reasons for the abuses in question; as a matter of fact, direct controls often relate directly only to the symptoms of the real trouble. In the synthesis seminar, the inevitable disagreement has arisen between capitalistic and socialistic persuasions. A working agreement has been found possible, however, that our real objectives are individual self-fulfillment and social justice, not any *-ism;* and that we should

[11]E.g., ". . . it [the 'folkish' view] feels the obligation in accordance with the Eternal Will that dominates this universe to promote the victory of the better and stronger, and to demand the submission of the worse and weaker." Adolph Hitler, *Mein Kampf*, II Chapter I (1927), Reynal and Hitchcock ed. (1939) p. 580.

seek to solve each practical problem by the most reasonable means, which will sometimes be capitalistic and sometimes socialistic in nature. The real disagreement is not one between two opposite systems; it narrows down to differences over what to do in limited, unsatisfactory areas of our present mixed economic system.

In the matter of culture, a dynamic equilibrium means above all an evolving synthesis of directive ideas. It means also a balance among the individual's interests, and among his loyalties to the groups in which he lives, from the smallest to the world community.

A third great instrumental value is democracy, in its several related meanings of equal and maximum opportunity for individual self-fulfillment, human rights, improvement in the status of the common man, sharing of knowledge and the arts, utilization of initiative from all, and the control of social policy by the people. Democracy must be cultivated in all its political, economic, social, cultural, and intercultural applications if it is to exert its full good influence. The attitudes the child learns in a democratic or an autocratic family reflect themselves in his attitudes toward a free or totalitarian order. Democracy involves the problem of humanizing our family relations, industrial relations, and political relations in such a way that values find a wider application in everyday life.

A fourth instrumental value is research into the cultural conditions that make for a just and durable social order. But such research is necessarily not disinterested; it is dominated by a purpose. It must be accompanied by pure research, therefore, as a control in case its motivation may lead to biased conclusions.

One of those cultural conditions is a certain minimum of physical welfare; and this we are now able to define accurately enough to indicate how the health conditions and practices of a population should be modified.

Another cultural condition is the skill of group cooperation, which must be fomented deliberately since it is a strategic necessity of a modern world order, and is not produced automatically by modern social conditions. The impracticability of coercion as an instrumental value makes a cooperative spirit all the more indispensable.

A most difficult set of cultural conditions makes up what is called the freedom of the individual. This poses a delicate problem even if we mean only external freedom, or multiplicity of choice. For the objective is not simply to facilitate all action classifiable as choice, but rather to concentrate upon permitting those choices that are most vital to good individuality. To the extent that social policy has to limit the individual's freedom of choice, all of us as policy makers must concern ourselves with the problem of defining good individuality.

The internal freedom of the individual — the freedom which the ancients defined as "the desire to do what one ought to desire to do" — brings us to a fifth instrumental value, the process of education. For whether those who educate want this responsibility or not, they cannot but influence the changing individual's disposition to choose one or another type of alternative. The crucial importance of what the individual is disposed to want appears at the bottom of every problem of our society. Economics, engineering, government — all our imposing fields of technical knowledge and power can only serve the wants that men ask them to serve. Education must develop the disposition to use them wisely.

This responsibility is heavier than it seemed in the decades when we trusted nature to do much of our job for us. To-day we do not entertain such high hopes for what material welfare and literacy may accomplish. These favoring conditions do not bring wisdom and civic responsibility as by-products. It would be just as unrealistic to expect all well-fed and literate people to love peace, as it would be to fear that they would inevitably grow slothful and indifferent. We must take little for granted in the matter of education. As we define the cultural conditions for a desirable world society, we must also reform our educational means to bring about those conditions.

As a sixth instrumental value let us cite the arts, for they constitute a means toward harmonious understanding among individuals as well as a direct means toward individual self-fulfillment. In the present study we have only briefly alluded to the arts, largely because we are dealing necessarily with knowledge about values more than with that experience of values which is the life of the arts. The seminar has not been so one-sided, for its vagabond discussions have often taken the group rather deep into the intimate reactions to art of the composer, the novelist, the painter, and the unashamed outsider. The question came to be hotly argued, for example, whether the sophisticated artist really found a richer self-fulfillment in great art than the outsider found in his low-brow favorites. As a result a useful concept was finally hammered out. To be good, art must be good *for* something, just as anything else must be. Some art is good for a momentary stimulation, but on longer acquaintance it grows tiresome. Other art, like Bach's music or Plato's *Dialogues,* remains an inexhaustible challenge to explore new depths of meaning. To call this art "better" than the shallow art is a perfectly justifiable ellipsis of expression. But if we can agree on the principle of distinguishing better from inferior art on the basis of its effect on the in-

dividual, then we can apply the same principle more widely; for art has many other observable effects besides those we have cited. Thus we do possess the means for a working agreement on excellence in the realm of the beautiful, as well as in those of the true and the good.

This much of the synthesis seminar's results suggests two or three practical ideas, despite the regrettable omission of the basis for believing that a synthesis of this peculiar, limited sort is needed and is potentially sound.

It would be very useful to form similar groups elsewhere: the participants would find the discussion educational for themselves at the very least. The ability of such discussion to serve many individual purposes at the same time provides for the necessary continuity of effort, through a continual rejuvenation of initiative from one quarter or another.

Once the huge problem of synthesis is divided into parts, in some such way as has been sketched out here, different groups should be able to compare their results and identify their common ground. Even as they are, the results just presented would provide a college student and his academic adviser with a better indication than they now have, of the range of concepts that must be mastered as part of a truly general education for our time.

And if the ability to recognize common purposes has any good effect on ideological conflicts, the process of piecing intellectual fragments into a ground of agreement may be worth refining as a means for coping with one of the stubbornest causes of hypertension in the world community.

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# TOWARD CONSENSUS BY CORRESPONDENCE

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An article of fundamental significance, by Howard Lee Nostrand, was begun in last autumn's MAIN CURRENTS, and concluded in the current issue under the title, "Some Elements for a Synthesis of a Contemporary Culture." The following is a working suggestion which has emerged out of reading that article.

The Nostrand article presents some preliminary findings which have developed out of the collective thinking of an informal group which has been at work at the University of Washington since 1941. One of the basic questions asked by this group was, "What methods are acceptable . . . as roads towards generally agreed propositions?" They made use of a discussion technique for the purpose of developing agreed propositions. The present article suggests that this process now be systematically extended to creative discussion by means of the interchange of documents between groups and individuals too widely scattered for face-to-face conferences.

This process of seeking consensus by correspondence has been employed in the Duke University Project, "Toward Consensus for World Law and Order." Under that title a brochure has already been published.[1] That brochure embodies briefs, agreed upon through correspondence, summarizing 14 plans for world law and order, with the pros and cons relative to each. Part II of the project report, entitled, "Areas of Agreement about World Order," is still in mimeographed form. It summarizes working agreements which have emerged, on two levels of consensus, as the result of correspondence with scores of supporters of the various plans.

The University of Washington project goes back to underlying fundamentals. It has been seeking consensus as to the basic method of establishing working agreements, starting with the most fundamental postulates of human thought. The Duke project has had to take for granted some such foundations. The present suggestion is that the method of seeking consensus by correspondence, which has proved successful in the Duke project, be now applied to the more fundamental questions, with regard to which the University of Washington project has used the face-to-face group-discussion method. Dr. Nostrand's article constitutes an initial document which may be used for a start. The present article is offered as a continuation of the process, inviting the widening participation of other readers of MAIN CURRENTS *in Modern Thought.*

The urgent importance of such a project becomes clearer when we recognize that no rapid and reliable progress can be made toward funda-

[1] *Toward Consensus for World Law and Order: a Cooperative Project,* viii + 57 pages, $1 a copy, cash to accompany order, Director of Duke Project, Box 4653, Duke Station, Durham, North Carolina, June, 1950.

mental synthesis unless it is possible to build up somewhere a body of working agreements which can be used as a foundation for further steps, and which can be taken for granted in subsequent discussions, until challenged, and disproved or amended. Part of the confusion of our age is due to the lack of any such body of working agreements, developed out of systematic and rigorous discussion. MAIN CURRENTS can render a crucial service if it will serve as the central forum in which a continually growing consensus on fundamentals can be developed through creative discussion by correspondence.

### *Suggested Modifications of the U. of W. Minimum Postulates*

In the first part of the Nostrand article,[2] five "minimum postulates" are presented as "the only necessary points of a working agreement which do not admit of proof." Since such postulates must provide the foundations upon which all subsequent agreements are to be developed, it is important that they be examined with searching criticism, and be formulated in as widely acceptable a manner as is practicable at the present moment. The University of Washington minimum postulates seem to the present writer to be essentially valid. On the other hand, certain additions and modifications would make them much more acceptable to me, and possibly to other participants (present and potential) in this discussion process.

1. As a fundamental methodological assumption, I propose that we accept Korzybski's rule: to use as foundations those propositions which cannot be denied without thereby being asserted.

2. The first of the U. of W. postulates ("The experiencing self exists at the moment") fulfills the Korzybski requirement. If one asserts, "I do not exist," the inevitable retort is, "Says who?" To deny one's own existence is to assert one's own existence. To do that would violate the U. of W. fourth postulate: "A proposition and its opposite cannot both be true."

3. Experience involves recurrent identifiable and recognizable patterns. Suppose one asserts, "There are no recurrent, recognizable, and identifiable patterns." This proposition would contradict itself because it is stated in terms of words. These words would be meaningless unless they were recognizable and identifiable when they recurred.

4. It is possible to establish at least some truths as a workable guide with respect to further exploration. If one denied that proposition, the denial itself would thereby be propounded as a truth serving as a guide with respect to further exploration, and therefore would be self-contradictory.

5. Postulates 2 and 3 in the U. of W. formulation impress me as needing further examination and more rigorous formulation in the light of the above propositions.

6. Postulate 5 in the U. of W. list reads as follows: "The realization of human values should be maximized." Antecedent to any such postulate would seem to be the need for agreement on the foregoing propositions, and also some such postulates as the following: "That is valuable which human beings on the whole and in the long run value." This proposition is a definiton rather than a self-evident axiom. It could be contradicted without immediate logical inconsistency. For example, one might take the position that that is valuable which God values — regardless of whether human beings on the whole and in the long run agree with God. Or, it might be held that the ultimate criterion of value is some scientific principle, with which human beings on the whole and in the long run might or might not agree. The criterion proposed here is essentially humanistic. If it is accepted, it opens the way to a series of factual investigations, involving the enumeration, classification, and analysis of the experiences and objects which human beings actually do on the whole and in the long run value. From such analysis, various inductive principles of evaluation can be developed.

If even a small group of the readers of MAIN CURRENTS is willing to participate in the proposed seeking of consensus by correspondence, the project can go forward. In that case, before exploring the possibility of agreement on higher levels, it is vital that the participants give their critical reactions to the postulates suggested above, in comparison with those proposed by the University of Washington group, and also in comparison with any other alternatives which seem to correspondents to be preferable to, or more useful than, either of the above.

Responses will be awaited with keen interest.

[2] MAIN CURRENTS, Vol. 7, No. 3, p. 81.

# AN ISOSCELES DISTRIBUTION OF MATERIAL ENTITLES

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When all material entities in the universe are distributed on co-ordinates of time and space, a regular pattern emerges. The entities range from sub-atomic particles to galaxies of stars and include all living things and human groups. If these entities are defined and classified as described below, then they are found to be distributed within an isosceles triangle (see cover). To see the evidence for this conclusion, the "entities" that fall into the isosceles distribution and the coordinates and units that produce the observed regularity will be presented first.

I. The scales of mass, time, and "rank" of science.

Our discussion concerns any material entity in the universe at one instant of time. Entities include quanta, electrons, atoms, molecules, cells, animals, people, plants, planets, stars, nebulas, or the entire universe. A material "entity" is here defined as anything at a given moment which has mass, or alternatively, one which occupies space. An entity may be a single object, a class of objects or a class of classes in ascending more inclusive heirarchy such as a particular gold atom; or the class of gold atoms (i.e., all the gold in existence); or the class of atoms of all kinds; etc. If entities within a class vary in mass, their average is taken to represent the class. Thus the average size of all human groups with their myriad subvarieties is perhaps best estimated as between 2 and 10 persons, i.e., in the class-interval of $10^{0}$ tons (in Fig. 1). The entities are the points, a few examples of which are plotted, within the triangle in Fig. 1.

Next, distribute these entities along the horizontal scale of mass from lightest to heaviest. This abscissa in Fig. 1 is an enormous scale, one hundred units long, where each unit is a full logarithmic cycle. It is a "centicycle" scale written as $10^{100}$ or a "1" with one hundred zeros after it. Its base unit is conveniently taken as a metric ton (though a proton or any other entity would serve). The ton is almost at center so that taking it as origin point makes the simplest equation. On either side of it this cosmic scale extends downward to $10^{-50}$ tons into the microcosm and upward to $10^{+50}$ tons into the macrocosm. On this vast scale, differences in density of different entities become relatively slight. Thus a correlation of .98 ($\pm$ .01) was observed between the mass and the size (diameters) of those entities for which these data could be secured. This means that mass and size are roughly interchangeable on this cosmic scale. Each entity was plotted according to its mass as more determinate, but one may also think of it as ranked along the horizontal scale in Fig. 1 according to its approximate size.

Next, distribute the entities along a vertical scale where the ordinate may be either the "rank" of the sciences or its correlated time dimension. This "rank," called R in Fig. 1, is simply putting the sciences into an order. This is the order of their inclusiveness:

| | *"Rank," R* |
|---|---|
| Social Sciences | 0 |
| Human Sciences | 1 |
| Biological Sciences | 2 |
| Physical Sciences | 3 |
| (Astronomical Sciences?) | (4?) |

The entities of each science are included in the entities of the sciences below it as biological entities are a part of all physical entities and human entities are included in biological entities, but not vice versa. (The symbolic logician writes this series of inclusions or subclasses with rigor as Social $\subset$ human $\subset$ biological $\subset$ physical.) Also each science uses the distinctive principles of the sciences below it but not the principles of the sciences above it. Thus biologists will use physical principles of "light," "heat," etc., but not human principles of "purpose," "planning," etc. The principles rank the sciences in a reversed series of inclusions, turning the logician's inclusion symbol around ( $\supset$ ). Both considerations together confirm the order of the sciences which agrees with the time-honored use in classifying the sciences in a hierarchy as above in universities and in popular thinking.

For an alternative vertical scale, which converges to identical conclusions, time may be substituted for the order of the science. Entities can be distributed by their evolutionary ages, i.e., into five broad periods of emerging in evolution, assigning them to the midpoints of those periods to minimize errors. With the logarithms of a century as the unit and the present as zero point, the five receding periods of the past and their chief characteristics emerge as follows:

Between a century and 10,000 years ago —
Civilization largely developed ..... $10^{0}$+

Between then and a million years ago —
Man largely evolved ..... $10^{2}$+

Between then and a million centuries ago —
Life largely emerged ..... $10^{3}$+

Between then and ten billion years ago —
Solar system was born ..... $10^{4}$+

Between then and a trillion years ago —
Universe existed ..... $10^{5}$+

This time scale correlates highly with the chief characteristics but not perfectly, for life began before a million centuries ago (even though most of its development was since then). Just how high this correlation is will depend both on more exact data and on the definitions of "life," "men," etc.

II. The isosceles distribution of all material entities.

The material entities in the universe, when plotted on these axes, fall regularly inside of an isosceles triangle. We have been unable to find any exceptions falling outside the triangle. Lines 1 and 2 in Fig. 1 bound the minimal and the maximal entities at each level (i.e., at each rank or period). This cosmic pattern of regularity is most firmly and exactly fixed by the left-hand straight line on which the minimal entities in each science fall. In simplest form the equation of this line is:

Log M = −11R, the mass-rank relation,* where M, the unit of mass, is metric tons. (If a "macrogram" = $10^{11}$ metric tons, i.e., $10^{17}$ grams, and m' is its exponent, then m' = −R.) This gives the following *minimal* entities:

when R = 0, the mass of a pair of persons, the lightest human group, (the entity studied in the Social Sciences) as in the class-interval of 1 ton ..... $10^{0}$ ton

when R = 1, the mass of a fertilized human ovum, the lightest whole human individual (the entity studied in the Human Sciences) as around ..... $10^{-11}$ tons

when R = 2, the mass of viruses, the lightest living entities, (studied in the Biological Sciences) as around ..... $10^{-22}$ tons

when R = 3, the mass of an electron, the lightest particle having "rest" mass, (studied in the Physical Sciences) ..... $10^{-33}$ tons

(when R = 4, the mass of radio photons around the boundary between the lightest quanta and waves, (about where physicists shift from particle to wave terminology) ..... $10^{-44}$ tons)

The minimal entities are neatly aligned. Their (log) differences in mass are all equal. The differences are all in jumps of ..... $10^{-11}$ tons

The right-hand line (with slope symmetric to the left-hand line of minimal entities) seems to bound the maximal entities of each science. Its equation is log M = + 11R or, if m' is the exponent on mass, m' = + 11R. All living persons and humanity as a whole (at the R = 2 level) and all individuals and classes of flora and fauna (at the R = 3 level) are within this boundary, though not on it. At the R = 4 level it "predicted" in 1941 the mass of the universe as $10^{74}$ protons, when only Eddington's estimate of $10^{79}$ was known to the author. Professor Harlow Shapley reported to the author in 1944 that his former estimate of $10^{73}$ had to be revised (because of the discovery of ten times as much dark as luminous matter), making his best estimate then $10^{74}$.

The isosceles triangle, defining this "isosceles mass-time relation" by m = ± 11R or by m = ± 11 (log T − 1.5), seems highly invariant. It is not altered by:

1. Measuring the horizontal axis in either units of mass or size;
2. Measuring the vertical axis in either units of time or order of inclusiveness of the sciences;
3. Shifting the origin points, size of units, or number of class-intervals;
4. Any finding that the age of "man," "life," etc. is greater than previously estimated. (Since greater ages only depress entities downward more surely within the triangle, making, perhaps, the fit of Line 1 to the minimal entities less exact.)

For some thousands of years still, even though the origin point, the present moment, moves forever onward, the triangle will remain an orderly description of the facts in its field. Beyond that, changing the definition of the top level to choose some later date to bound the beginning of the symbol-using human group, will keep the triangle an accurate semantic device to bring out "law and order" in the cosmos.

*This equation simplifies and corrects its misprinted form in Philosophy of Science, Vol. II, No. 4, October, 1944. The equations there are coordinates of the critical points on the triangle and should have the equality sign replaced by a colon. The editor was not at fault as the proofs never reached the author who was cut off in the Mediterranean war zones, and his correction reached the editor after the journal was published.

The present paper also presents new evidence on this isosceles distribution.

III. Implications of the "mass-time triangle."

Among the *controversial questions* in the diagram is the question of whether it should include the astronomical level E (in dashed lines and question marked in Fig. 1). The phenomena of level E are known to us only through radiation as energy while the phenomena of level D are also known to us through molar matter having "rest" mass, such as meteors. But this boundary between pure energy vs. matter seems to some critics to be not as clear cut as boundaries between the higher levels. If level E is excluded, the isosceles triangle becomes an even more accurate picture of regularity, but only within our solar system.

If, on the other hand, level E is included and the ranking of the sciences by the inclusiveness principle is the vertical coordinate, then the correlation of this ranking with evolutionary age becomes much more speculative in level E. Did radiant energy precede any nucleation of it in "vortices" which became electrons, protons, neutrons, etc.? Did matter "build up" out of radiation such, perhaps, as the cosmic rays? The diagram seems to imply this. But we have no evidence that far back into time where even our time scales become uncertain and fade into speculative mist. But physicists prefer not to speculate where no data exists. Consequently we have clearly labelled level E as questioned in Fig 1. Without level E the diagram portrays the isosceles regularity within our solar system; with level E the regularity extends to the universe. If the ranking is the basic ordinate no difficulty results . But if time is the ordinate, the priority of level E is unknown. Partly for this reason we prefer to use the ranking as the firmer ordinate or basic phenomenon and the evolutionary ages as an imperfectly correlated variable or epi-phenomenon.

Another controversial question concerns the accuracy of our data. What becomes of the isosceles regularity if scientists should greatly revise their present estimate of ages or sizes of the entities? If the revisions are to make things older and nearer the midsize (which is one cubic meter, or one metric ton of water) the isosceles distribution, defined by $m = \pm 11R$, is unaffected. For such revision keeps the entities inside the isosceles triangle by moving them downward and inward. But if any revised estimates of entities on the boundary lines make them much younger or much lighter (if on the $m = -11R$ boundary) or much heavier (if on the $m = +11R$ boundary), then the isosceles distribution will be affected. The scientist would then modify this isosceles distribution theory to fit the new facts — assuming the revised estimates were different enough and sure enough to justify adjusting the isosceles hypothesis summarized in $m = \pm 11R$. To see how this might be done consider the most likely revision — a new estimate of the mass or age of the universe. Suppose the universe is found to be younger than 10 billion years, thus moving it upwards in Fig. 1 into the level D class-interval. The scientist in general may react to the new discrepancy by one of three rules:

1. By modifying his *definitions* of the variables so as to eliminate the newly found inconsistency, or
2. By modifying his *statement of relations* between variables, i.e., refining his formula, so as to integrate the new fact, or
3. By *suspending judgment* while he investigates further, searching for deeper harmonizing or synthesizing principles.

In the case in hand by the first rule, the "universe" might be redefined to mean, not its present form if that proves to have been "born" less than 10 billion years ago, but the form it had prior to such a cataclysmic "birth" event. The isosceles regularity would then still hold. Alternatively, by the second rule, the scientist could modify the relation, $m = +11R$, to another slope of line such as $m = +xR$ where x is such as to make the line bounding the maximum entities at each level go through the new point representing a younger universe. The triangular regularity of distribution of material entities would still hold but it might not be isosceles any longer. Alternatively he may follow the third rule and suspend judgment pending further research. He may say $m = \pm 11R$ are only lines of best fit and the fit at one of the nine points of Fig. 1 appears to be less close than it appeared in 1950. His further research may lead to an utterly new formulation abandoning Fig. 1, or it may lead to a refinement in Fig. 1. For one such refinement, suppose the universe were found to be much heavier than $10^{44}$ tons which was Shapley's estimate in 1944. This point would be outside the present isosceles triangle if the age of the universe were put at the point of the time class-interval which is level E in Fig. 1. But since no beginning of time is known, it is a crude approximation or even an error to date the age of the universe which may have existed *in some form* indefinitely back into the past. If a finite class-interval E is used, it would be a refinement to place the universe at the bottom of it as at least existing in some form a trillion years ago. Moving the universe point down to the $100^6$ line permits estimates of its mass to rise from $10^{44}$ up to $10^{50}$ and still be within the present isosceles triangle.

All these technics and many others enable the scientist to describe and predict phenomena by means of symbolized regularities which he calls scientific laws when firmly established.

The clearness of the isosceles distribution depends, as usual in science, on the unambiguous

definitions of terms and classes consistently adhered to. Here mixed entities such as material culture, or man-made objects can yield confusion. One way to avoid ambiguity is to classify entities by their content in nature as unprocessed by man, as then they can be readily sorted into the physical-inorganic level, the living level, the human level, and the level of the symbol-mediated cultural group.

The validity of this hypothesis, that all material entities are included within the isosceles triangle on these coordinates of mass and rank-in-inclusiveness or age-in evolution, may be tested by searching for a single exception. Is there any entity which when properly classified as to level has a mass outside the limiting lines 1 and 2? None has yet been found. Every alleged exception thus far seems to use other definitions of the terms and hence be inadmissable evidence.

Perhaps the most controversial definition is to consider human groups as one class of entity, rather than as many classes. This entails a single point which is fixed by the rule that wherever members of a class vary in mass their average is taken. This average is probably in the single log class-interval of 2 to 10 persons since the innumerable pairs or trios of conversers are vastly more numerous than larger groups such as nations.

Two considerations dictated this choice in defining the human groups as a single entity. One consideration is that this definition yields law and order — the isosceles distribution — whereas any other spreads the apex of the triangle destroying any scientific law. Scientists in seeking laws, i.e., symbols developing regularity in phenomena, should choose those terms and definitions of them which best achieve this scientific goal. Another consideration is consistency with definitions of other entities. All entities are defined as masses observable at any one moment debarring their history at previous moments lest each mass be unlimitedly repeated. Most classifications of human groups involve the history of persons. For a human group, defined as people interacting in stimulating and responding to each other are mostly latent since at any one moment each person can be interacting with a limited number of others usually in one group and all his other groups are at that moment inactive to him. Classifying groups by regions or institutions, or other bases all involved this "history error" of not sticking to a moment's cross-section of time and hence of counting a person many times. Rigorous consistency in definitions requires a census of everyone's interacting at one moment to observe all the human groups of that moment (taken as a sample of any and all moments). "Everyone interacting with others at a moment" is the one class of group to be observed. Sub-classifying this class into many classes or entities merely means each is a partial or inadequate classification of the field.

This difficulty in classifying so as to avoid reduplicating is highly peculiar to human groups. Man as the time-binding animal lives in many groups in succession within his lifetime or even within each day. For people are simultaneously members of many groups though usually attending to only one actively interstimulating set of persons at a given moment. Duplicating by adding entities together in more inclusive classes as "gold atoms" plus "other kinds" yielding the class "all atoms" is permitted and done at every level in Fig. 1 as one moves rightward on it. But duplicating by an alternative classification is a semantic manipulation which combines different symbols for classes without having correspondingly different referents. This "duplication fallacy" partly results from the "history error" in considering groups at more than one moment in time and so violating the definition of material entities here.

The rigorous logic in classifying human groups is difficult to compress into a few sentences here. The reader may try it and submit his results to fellow scientists in all fields whether philosophers and logicians or physicists or sociologists (as the author has done). No other classification than the one finally adopted here (to take all interacting sets of persons at a moment as one omnibus class and average its memberships of these sets) seems rigorously consistent with the definitions and classifying at the other levels.

It is possible to make *predictions* from the graph as hypotheses awaiting the test of time. These inferences lack any rational explanatory theory at present. But by noting intersections of the various mid-level lines A, B, C, D, and E, in Fig. 1, with the sides of the triangle, various highly speculative inferences can be made. One inference was the mass of the universe noted above which remains an interesting coincidence until further facts may make predictions from the diagram more probable. Other inferences are:

a. The maximum number of people possible i) on our earth, ii) in the solar system, iii) in the universe;
b. the maximum mass of living matter similarly;
c. the convenient boundary between our nebula (level D) and what is beyond it (level E);
d. the convenient boundary between particle terminology and wave terminology in the radio band (level E);
e. the convenient boundary for bio-chemists to adopt between what to call "living" and what to call "non-living" in the range between protein molecules and cells.

*Further periodicities* may emerge with more research. If a sheaf of lines is drawn through the apex, making equal angles with each other, they may classify entities usefully with hitherto un-

suspected regularities emerging. Systematic properties may be discovered as in the Mendelyeev periodic table of the atomic elements. Suggested leads to explore in further research are:

1. The average mass, in level D, of: electrons, atoms, molecules, colloids, crystals . . . (gap?) . . . meteors, satellites, planets, stars, nebulae.
2. In level E, radio photons, visible photons, cosmic ray photons, etc.
3. In level C, viruses, cells, protozoa, chordates, vertebrates, primates, maximal mammals.
4. In level B, critical points in the embryonic development of the human ovum, blastula, foetus, baby, adult.

The final question usually asked is for an evaluation — is the triangle a "scientific law" (if corroborated, as reported here, by other scientists) or is it is semantic device, a diagram merely? The answer depends in part on definition of terms. If "law" in science means man's *statement* (in some kind of symbols) of a uniform aspect he has observed in phenomena — as scientists are increasingly viewing their laws — then the equation $m = \pm R$ is a (candidate) law. The symbols chosen here* were logs of mass, and of past centuries, or a logical ranking of the sciences, and they developed the simple regularity $m = \pm R$. They "manufactured" it in Eddington's phrase.

Scientists discard old concepts and generalizations and adopt those new ones which create law and order — by means of man's better adapted symbolic responses to his environment. Thus it may be argued: define the lower limit of the "living," the average human "group," the boundary between "our nebula" and the galaxies beyond it, the boundary between particles and waves in relativity physics (if these terms are in controversy) by means of the equation, $m = \pm R$, so as to make a more orderly and law abiding system out of our scientific knowledge.

*This choice of symbols resulted from the author's "S-system" of dimensional Sociology which starts classifying all observables into the four classes of "time," "space," "people," and "all else." A second level of classifying was by their exponents or logarithms. Cross-classifying these classes on a sheet of paper discovered the isosceles triangle. All this dimensional Sociology is developed in the author's *Dimensions of Society* (Macmillan, 1942 pp. 944) and more simply with more applications, in his *Systematic Social Science* (Department of Sociology, University of Washington, Seattle, 1947, pp. 785), a typed offset edition for trial and critical revision by colleagues, in advance of publication.